Actuarial Report

(21st)

on the

CANADA PENSION PLAN

As at 31 December 2003

Office of the Superintendent of Financial Institutions Canada
Office of the Chief Actuary

Bureau du surintendant des institutions financières Canada
Bureau de l'actuaire en chef

Canada

To obtain a copy of this report, please contact:
Office of the Chief Actuary
Office of the Superintendent of Financial Institutions Canada
12th Floor, Kent Square Building
255 Albert Street
Ottawa, Ontario
K1A 0H2

Facsimile: (613) 990-9900
E-mail: oca-bac@osfi-bsif.gc.ca

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18 November 2004

The Honourable Ralph Goodale, P.C., M.P.
Minister of Finance
House of Commons
Ottawa, Canada
K1A 0G5

Dear Minister:

In accordance with section 115 of the *Canada Pension Plan*, which provides that an actuarial report shall be prepared every three years for purposes of the contribution rate review by the Minister of Finance and the ministers of the Crown of the provinces, I am pleased to submit the Twenty-First Actuarial Report on the Canada Pension Plan, prepared as at 31 December 2003.

Yours sincerely,

Jean-Claude Ménard

Jean-Claude Ménard, F.S.A., F.C.I.A.
Chief Actuary

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I. Executive Summary

This is the Twenty-First Actuarial Report since the inception of the Canada Pension Plan (CPP) in 1966. It presents the financial status of the Plan as at 31 December 2003. The previous triennial report is the Eighteenth Actuarial Report as at 31 December 2000, which was tabled in the House of Commons on 10 December 2001.

The Canada Pension Plan was subject to a series of amendments since the Eighteenth Actuarial Report pursuant to the adoption of Bill C-3 and Part 4 of Bill C-30. The effects of these amendments were covered in the Nineteenth and Twentieth Actuarial Reports, which were tabled 17 June 2002 and 20 April 2004, respectively, in the House of Commons. Part 4 of Bill C-30 received Royal Assent on 14 May 2004. According to the legislation, the coming into force of CPP amendments requires the formal approval of at least two-thirds of the provinces representing two-thirds of the population. This is in process and should be completed in due course. The effects of Bill C-3 and Part 4 of Bill C-30 are included in the financial projections of this report.

A. Purpose of the Report

This report has been prepared in compliance with the timing and information requirements of the *Canada Pension Plan*. Section 113.1 of the Act provides that the Minister of Finance and ministers of the Crown of the provinces shall review the state of the CPP once every three years, and may consequently make recommendations to change the benefits or contribution rates, or both. Section 113.1 identifies the factors they consider in their review, including information to be provided by the Chief Actuary.

Another important purpose of the report is to inform contributors and beneficiaries of the current and projected financial status of the Plan. It provides information to evaluate its financial sustainability over a long period, assuming the Act remains unchanged. Such information should facilitate a better understanding of the financial status of the Plan and the factors that influence costs, contributing to an informed public discussion of issues related to it.

B. Scope of the Report

Section II presents the general methodology used in preparing the actuarial estimates included in this report, which are based on the key "best-estimate" assumptions described in Section III. Section IV includes the projections of the income, expenditures and assets of the Plan over the next 75 years. Section V summarizes the financial results under alternative younger and older population scenarios. The impact of financial markets volatility on the financial status of the Plan is also examined.

Section VI presents a general conclusion about the financial status of the Plan, while Section VII consists of the actuarial opinion. The various appendices provide for supplemental information on the provisions of the Plan, the description of the data, the assumptions and methods employed, the sensitivity analysis and the long-term financial sustainability of the Plan. The reconciliation of the results with those presented in the Eighteenth Report and the financial results under the steady-state contribution rate are also shown.

C. Main Findings

The results of the actuarial projections of the financial status of the Canada Pension Plan presented in this Twenty-First Report are generally consistent with the trends revealed in the previous triennial actuarial report.

- Demographic changes will have a major impact on the ratio of workers to retirees; the ratio of the number of people aged 20 to 64 to those aged 65 and over is expected to fall from about 4.9 in 2004 to 2.3 in 2050.
- The pay-as-you-go rate is expected to increase steadily from 8.3% in 2004 to 11.3% by 2050, mainly driven by the retirement of the baby boom generation.
- The steady-state contribution rate, which is the lowest rate sufficient to sustain the Plan without further increase, is 9.8% of contributory earnings. This rate is the same as presented in the previous triennial actuarial report and 0.1% lower than the legislated 9.9% contribution rate.
- With the 9.9% legislated contribution rate, the assets are expected to increase significantly over the next 17 years, with the ratio of assets to the following year's expenditures growing from 3.1 in 2004 to 5.6 by 2021.
- Total assets are expected to grow from $68 billion at the end of 2003 to $147 billion by the end of 2010.
- During the period 2004 to 2021, contributions are more than sufficient to cover the expenditures. Thereafter a proportion of the investment earnings is required to make up the difference between contributions and expenditures. In 2050, the proportion of investment earnings is 29%.
- Investment earnings, which represent 14% of revenues (i.e. contributions and investment earnings) in 2004, will represent 27% thereof in 2020. In 2050, investment earnings represent 32% of revenues. This clearly illustrates the importance of the investment earnings as a source of revenues to the Plan.

D. General Conclusions

The results contained in this report confirm that the legislated contribution rate of 9.9% in 2004 and thereafter is sufficient to pay for future expenditures and to accumulate assets worth $147 billion (i.e. 4.4 times the annual expenditures) in 2010. In 2050, the assets are projected to be $1,554 billion or 6.3 times the annual expenditures.

The steady-state contribution rate determined under this report is 9.8%. Better than anticipated economic experience, especially regarding labour force participation and employment data, over the period 2001 to 2003, combined with the amendments since the last report have put downward pressure on the steady-state contribution rate. On the other hand, a more pessimistic demographic outlook, due to the continuing downward trend in fertility rates and increases in longevity, combined with lower expectations with respect to inflation and rates of return on investments have put upward pressure on the steady-state contribution rate. These factors tend to counterbalance each other, leaving the steady-state rate unchanged at 9.8%.

To measure the sensitivity of the long-term projected financial position of the Plan to changes in the future economic and demographic outlook, two demographically based scenarios that portray a generally younger and older population were developed. The younger and older population scenarios produced steady-state contribution rates of 9.3% and 10.3%, respectively.

Under the 9.9% legislated contribution rate, the assets are projected to grow rapidly over the next 17 years as contribution revenues are expected to exceed the expenditures over that period. Assets will continue to grow until the end of the projection period, but at a slower pace, and the ratio of assets to the following year's expenditures (asset/expenditure ratio) is expected to reach a level of 6.3 by 2050. These are indicators that the Plan is sustainable over the long term, as it is projected that there will be more cash inflows than outflows over the entire projection period. The pool of assets generated over the projection period provides the Plan with the capacity, through investment earnings, to absorb a wide range of unforeseen economic or demographic fluctuations, which otherwise would have to be reflected in the legislated contribution rate. Thus, despite the projected substantial increase in benefits paid as a result of an aging population, the Plan is expected to be able to meet its obligations throughout the projection period.

II. Methodology

The actuarial examination of the Canada Pension Plan involves projections of its revenues and expenditures over a long period of time, so that the future impact of historical and projected trends in demographic and economic factors can be properly assessed. The actuarial estimates in this report are based on the current provisions of the Plan, data regarding the starting point for the projections, "best-estimate" assumptions regarding future demographic and economic experience, and a methodology for translating this information into estimates of future revenues and expenditures.

The revenues of the Plan include both contributions and investment earnings. The projection of contributions begins with a projection of the working-age population. This requires assumptions regarding demographic factors such as fertility, migration and mortality. Total contributory earnings are derived by applying labour force participation and job creation rates to the projected population and by projecting future employment earnings. This requires assumptions such as wage increases, an earnings distribution and unemployment rates. Contributions to the Plan are obtained by applying the contribution rate to contributory earnings. Investment earnings are projected on the basis of the existing portfolio of assets, projected net cash flows and the assumed rates of return on investments.

Expenditures are made up of the benefits paid out and administrative expenses. Newly emerging benefits are projected by applying demographic assumptions regarding retirement, disability and death to the eligible populations, together with the benefit provisions and the earnings histories of the participants. The projection of total benefits, which include the continuation of benefits already in payment at the valuation date, requires further assumptions, along with an assumption regarding the rate of increase in prices. Administrative expenses are projected based on historical experience. The assets at the end of any year are thus determined by adding the excess of revenues over expenditures for the given year to the assets at the end of the previous year.

The assumptions and results presented in the following sections make it possible to measure the financial status of the Plan in each projection year and to calculate a steady-state contribution rate. The steady-state contribution rate is defined as the lowest level contribution rate applicable after the end of the review period, rounded to the nearest 0.1% that results in the asset/expenditure ratio being the same in the 10th and 60th year following the end of the review period. For this Report, the end of the review period is 2006. Therefore, the steady-state contribution rate is applicable for years 2007 and thereafter and the relevant years for the determination of the steady-state contribution rate are 2016 and 2066.

A wide variety of factors influence both the current and projected financial position of the Plan. Accordingly, the results shown in this report differ from those shown in previous reports. Likewise, future actuarial examinations will reveal results that differ from the projections included in this report.

III. Best-Estimate Assumptions

A. Introduction

The information required by statute, which is presented in Section IV, requires making several assumptions regarding future demographic and economic trends. The projections included in this report cover a long period of time (75 years) and the assumptions are determined by putting more emphasis on historical trends than on short-term trends. These assumptions reflect our best judgement and are referred to in this report as the "best-estimate" assumptions. The assumptions were chosen to form a coherent whole, taking into account certain interrelationships among them.

An independent panel of actuaries reviewed the Eighteenth Actuarial Report and released a report in March 2002. The Review Panel supported the actuarial conclusions reached by the Chief Actuary about the soundness of the Canada Pension Plan. The Review Panel found that the Eighteenth Actuarial Report was prepared in accordance with professional standards, and that the assumptions used by the Chief Actuary were reasonable and within acceptable ranges. The Review Panel report made a series of recommendations dealing with data, methodology, assumptions and communication of results. For the Twenty-First Actuarial Report, the Office of the Chief Actuary (OCA) took action on those recommendations.

The Chief Actuary held a seminar on the demographic and economic outlook for Canada to get opinions from a wide range of individuals with relevant expertise. The seminar was held in May 2003. Four experts in the fields of demography, economics and investments were invited to present their views. Amongst the participants at the seminar were representatives of the OCA, Social Development Canada and the Department of Finance, as well as representatives of provincial and territorial governments. Furthermore, representatives of the OCA attended a seminar held by the Québec Pension Plan (QPP) in September 2003. The various papers presented at both seminars are available from the OCA's website.

Table 1 below presents a summary of the most important assumptions used in this report and those used in the previous triennial report. The assumptions are described in more detail in Appendix B of this report.

Table 1 Best-Estimate Demographic and Economic Assumptions

Canada	21st Report (as at 31 December 2003)	18th Report (as at 31 December 2000)
Total fertility rate	1.60	1.64
Net migration rate	0.50% of population to 2015 0.54% of population for 2020+	0.50% of population to 2015 0.52% of population for 2020+
Mortality	1995-97 Life Tables for Canada with future improvements	1990-92 Life Tables for Canada with future improvements
Canadian life expectancy at birth	2005 2025 Males 78.0 years 80.7 years Females 82.6 years 84.1 years	2005 2025 Males 77.0 years 78.8 years Females 82.0 years 83.2 years
CPP disability incidence rates (per 1,000 eligible)	Males 3.25 Females 3.50	Males 3.25* Females 2.75*
Unemployment rate	6.5% (2020)	6.5% (2015)
Participation rate (aged 15-69)	73.4% (2030)	72.5% (2030)
Employment rate (aged 15-69)	68.6% (2030)	66.5% (2030)
Real-wage differential	1.2% (2012+)	1.1% (2015+)
Rate of increase in prices	2.7% (2015+)	3.0% (2015+)
Real rates of return	4.1% (2011+)	4.2% (2011+)

* The disability incidence rates are not comparable between the two reports since the methodology has been changed. The 18th CPP Report rates would have been higher using the new methodology (see Appendix B, section V-E).

B. Demographic Assumptions

The demographic projections start with the Canada and Québec populations on 1 July 2003, to which are applied fertility, migration and mortality assumptions. The relevant population for the Canada Pension Plan is Canada less Québec and is obtained by subtracting the projected results for Québec from those for Canada. The population projections are essential to determine the future number of CPP contributors and beneficiaries.

The distribution by age of the population of Canada less Québec has changed considerably since the inception of the Plan in 1966, with the population aging each year since then. The causes of this aging are examined in the following subsections.

1. Fertility

The first cause of the aging of the Canadian population is the large drop in the total fertility rate over the last three decades, relative to the baby boom generation born between the mid-1940s to the mid-1960s. The fertility rate in Canada has dropped rapidly from an average level of about 4.0 per woman in the 1950s to 1.75 in the late 1970s and to 1.62 over the last two decades. The same observations can be made for Québec except that fertility rates are slightly lower.

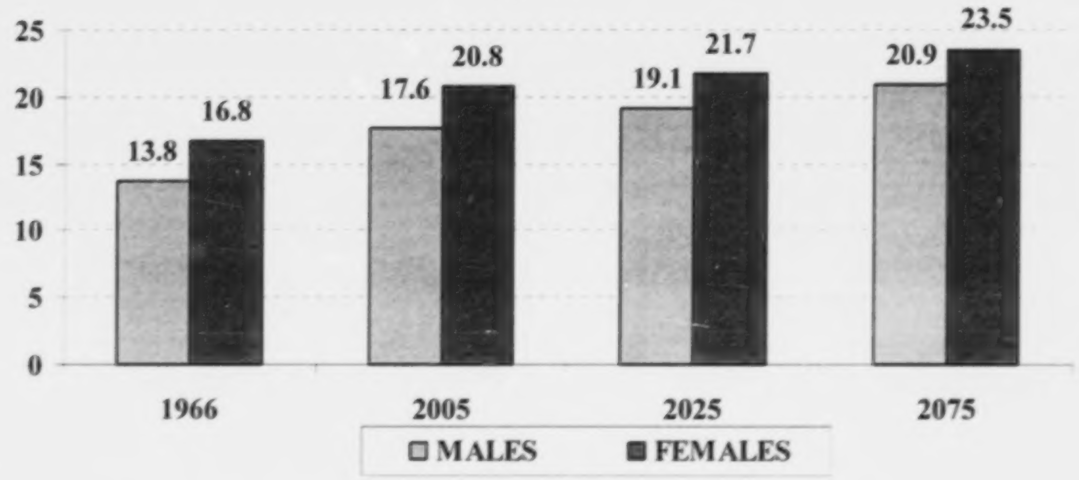
The decrease occurred as a result of changes in a variety of social, medical and economic factors. It is unlikely that fertility rates will return to historical levels in the absence of significant societal changes. It is assumed that the total fertility rate for Canada will increase slightly from its 2001 level of 1.51 (1.45 in 2002 for Québec) to an ultimate level of 1.60 in 2016 (1.55 in 2017 for Québec). As a result, the total fertility rate for Canada less Québec is assumed to be 1.61 in 2017 and thereafter.

2. Mortality

Another element that has contributed to the aging of the population is the significant reduction in age-specific mortality rates. This can be best measured by the increase in life expectancy at age 65, which directly affects how long retirement benefits will be paid to the beneficiaries. Life expectancy at age 65 has increased 24% for men between 1966 and 2001, rising from 13.8 to 17.1 years. For women, life expectancy at age 65 has increased 23%, from 16.8 to 20.6 years over the same period.

Mortality improvements are expected to continue in the future, but at a slower pace than observed over the last 25 years. The ultimate rates of improvement were established by adjusting the results of a detailed study prepared by the Social Security Administration in the United States. The adjustments are to reflect, in part, historical differences between Canada and the United States. Rates of improvement for the period 2002 to 2006 are assumed to be equal to those experienced over the period 1991 to 2001 and then gradually reduce to their ultimate levels by year 2026. Chart 1 shows the changes in life expectancy at age 65 since the Plan inception in 1966 to the end of the projection period.

Chart 1 Trend in Life Expectancy at Age 65
(Canada)



3. Net Migration

Net migration (i.e. the excess of immigration over emigration) is unlikely to materially reduce the continued aging of the population unless (1) the level of immigration rises significantly above what has been observed historically and (2) the average age at immigration falls dramatically.

Net migration to Canada was 0.45% of the population in 2003 and has averaged 0.50% of the population over the last 30 years. Based on a continuation of these net migration levels and the expected pressure on the labour markets due to the impending retirement of the baby boom generation, an ultimate assumption of 0.54% of population has been established for years 2020 and beyond. The initial level of 0.50% is kept constant from 2004 until 2015, then increases uniformly to reach an ultimate level of 0.54% for 2020 and thereafter to take into account the effects of the anticipated labour shortage. The ultimate 0.54% is comparable to actual averages observed over the last 10 and 15 years. To project the Québec population, a net migration rate of about 0.4% is assumed over the projection period.

4. Population Projections

Chart 2 shows the evolution of the Canada less Québec population age distribution since the inception of the Plan. One can easily observe that the triangular shape of the 1970s is becoming more rectangular, thus leading to an older population on average. The effects of the baby boom and baby bust can be seen. The chart also reveals that the number of people aged 85 and over is expected to increase dramatically over the next 50 years.

Table 2 shows the population for three age groups (0-19, 20-64 and 65 and over) over the projection period. The ratio of people aged 20-64 to those aged 65 and over is a measure that approximates the number of working-age people to retirees. Because of the population aging, this ratio drops by more than half during the projection period, from 4.9 in 2004 to 2.3 in 2050.

Chart 2 Population Distribution of Canada less Québec
(thousands)

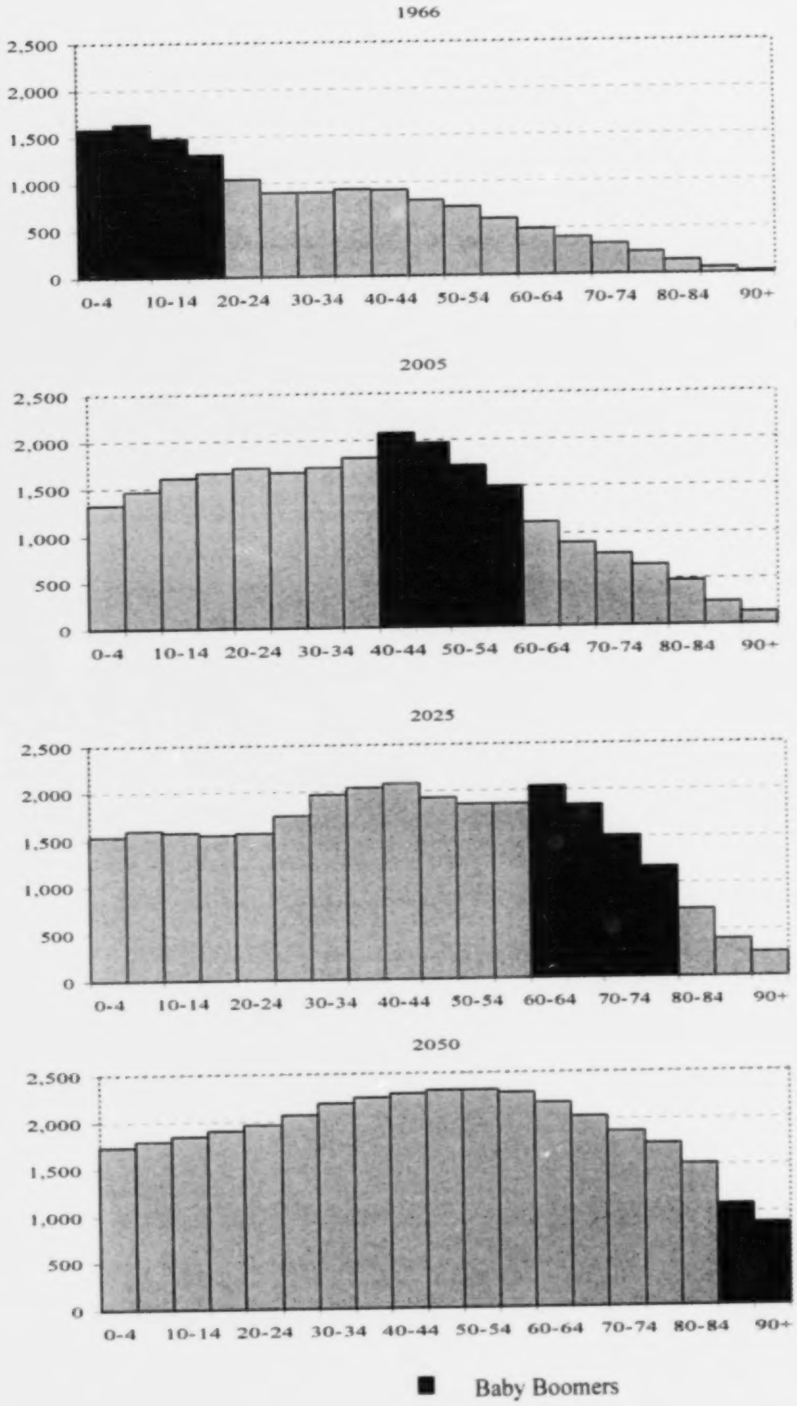


Table 2 Population of Canada less Québec
(thousands)

Year	Total	Age 0-19	Age 20-64	Age 65 and Over	Ratio of 20-64 to 65 and Over
2004	24,366	6,120	15,131	3,116	4.9
2005	24,590	6,079	15,337	3,174	4.8
2006	24,813	6,042	15,530	3,240	4.8
2007	25,037	6,015	15,711	3,311	4.7
2008	25,261	5,994	15,873	3,394	4.7
2009	25,487	5,970	16,038	3,479	4.6
2010	25,714	5,939	16,210	3,566	4.5
2015	26,879	5,889	16,760	4,230	4.0
2020	28,104	6,028	17,071	5,004	3.4
2025	29,273	6,261	17,115	5,897	2.9
2030	30,315	6,439	17,103	6,774	2.5
2040	31,937	6,526	17,822	7,590	2.3
2050	33,190	6,692	18,381	8,117	2.3
2075	36,228	7,279	19,863	9,085	2.2

C. Economic Assumptions

The main economic assumptions related to the Canada Pension Plan are the labour force participation rates, employment rates, unemployment rates and average employment earnings increases. For benefit and asset projection purposes, assumptions regarding the rate of increase in prices and rates of return on invested assets are also required.

One of the key elements underlying the best-estimate key economic assumptions relates to the expected labour shortage due to the aging of the population and the retirement of the baby boom generation between 2010 and 2030. Labour force growth will weaken as the working age population expands at a slower pace. The outlook for the participation rates also points to slower labour force growth. Growing labour shortages, especially after 2010, are assumed to force higher real wage growth. The higher real wages may help keep people in the labour force who might otherwise retire. The net result is a small reduction in the unemployment rate.

1. Labour Force

Employment levels are reflected in the projections through the assumption regarding the proportions of the population, by age and sex, who have earnings in a given year. These proportions vary not only with the rate of unemployment, but also reflect trends to increased workforce participation by women, longer periods of formal education among young adults and changing retirement patterns of older workers.

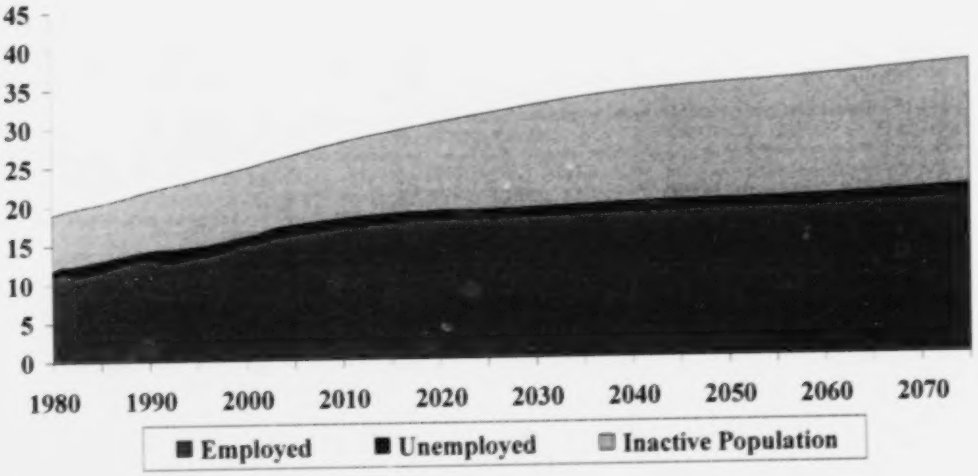
Because of the aging of the population, the labour force participation rates for Canadians aged 15 and over are expected to decline from 67.4% in 2004 to 61.1% by 2030. A more useful measure of the working age population is the participation rates of those aged 15 to 69, which are expected to decline from 74.9% in 2004 to 73.4% in 2030. The participation rates of those aged 60 to 69 are gradually increased after 2003. Moreover, the narrowing of the gap between the age-specific participation rates of men and women continues but at a much slower pace than in the past, except for certain age groups.

Recent significant increases were experienced in both younger and older age groups for both males and females. Rates for females aged 15 to 19 increased more than for males recently, and this trend is projected to stabilize at a difference of 1% in the near term. In the early part of the projection period, the gap between male and female rates increases slightly for some age groups as male rates are projected to increase slightly faster; however, over the long term the gap is projected to decrease for all groups except for the group aged 15 to 19. Overall, rates for females aged 15 to 69 are projected to increase more than for males, primarily for those aged 30 to 49.

The job creation rate in Canada was 1.8% on average from 1976 to 2003, based on available employment data; it is assumed that the number of jobs increases by 1.2% in 2004. From 2005 to 2010, the job creation rate is about 1.0% on average and 0.6% from 2010 to 2020. For 2020 and thereafter, because of the aging of the population, the job creation rate follows the labour force growth rate of about 0.3%.

The job creation rate is determined on the basis of the short-term economic outlook and the unemployment rate, which averages about 7.5% from 2004 to 2008. Thereafter, the relative stability of the labour force makes it possible for the unemployment rate to decrease to 6.5% around 2020.

Chart 3 Distribution of the Canadian Population Aged 15 and Over
(millions)



As shown in Chart 3, the number of employed aged 15 and over increases from about 11.0 million in 1980 to 19.0 million by 2050. At the start of the projection period in 2004, employment is set to reach 15.9 million. As annual employment growth is projected to decline gradually to about 0.3%, the average annual increase in employment from 2004 to 2050 reduces to 0.4%. The number of unemployed aged 15 and over increases from approximately 0.9 million in 1980 to 1.3 million in 2050.

The labour force or the active population (that is, total employed and unemployed populations) thus increases from 11.9 million in 1980 to 17.2 million in 2004 and then to 20.3 million in 2050, which gives an average annual increase of 0.4% from 2004 to 2050. Correspondingly, the inactive population (those not in the labour force) aged 15 and over increases from 6.6 million in 1980 to 8.3 million in 2004 and then to 13.9 million in 2050, which gives an average annual increase of 1.1% from 2004 to 2050.

The combined impact of a decrease in the labour force participation rate and a gradual increase in the population aged 15 and over leads to an overall moderate increase in the labour force. The labour force grows at a slower rate than the population and the overall participation rate decreases because of the aging of the population, as shown in Chart 3.

2. Price Increases

Price increases, as measured by changes in the Consumer Price Index, tend to fluctuate from year to year. Based on historical trends, the renewed commitment of the Bank of Canada and the Government to keep inflation between 1% and 3% until 2006 and long-term economic forecasts, an ultimate rate of price increase of 2.7% has been assumed for 2015 and thereafter. Recognizing recent experience, the rate of price increase is assumed at 2.0% for years 2004 to 2008. From 2009, the rate is then uniformly increased to its ultimate level of 2.7% in 2015.

3. Real Wage Increases (Average Annual Earnings)

Wage increases impact the financial balance of the Canada Pension Plan in two ways. In the short term, an increase in the average wage translates into higher contribution income, with little immediate impact on benefits. Over the longer term, higher average wages produce higher benefits. The long-term projected financial status of the Plan is more dependent on the differential between the assumed annual rate of wage increases and price increases (the real-wage differential) than on the level of wage increases.

Many factors have influenced the real rate of increase in average annual wages, including general productivity improvements, the move to a service economy, decreases in the average hours worked and fluctuation in the size of the workforce. Considering these factors, together with the historical trends, the expected labour shortage and various long-term economic forecasts, an ultimate real wage differential of 1.2% is assumed for 2012 and thereafter. Combined with the price increase assumption described above, this results in an assumed annual increase in wages of 3.9% in 2015 and thereafter.

Furthermore, the current difference between the real rate of increase in the Average Weekly Earnings (AWE) used in the projection of the Year's Maximum Pensionable Earnings (YMPE) and the real rate of increase in the average annual earnings (AAE) has been recognized. However, consistent with the long-term relationship between the real increases in the AWE and AAE, the difference is assumed to reduce to zero over the next five years. Taking into account the latest trends in the AWE, the real increase in AWE is assumed at -0.3% for 2004. For 2005, the real increase in AWE is assumed at 0.2% and then is gradually increased to reach 1.2% by 2012. For the period 2004 to 2007, the real increase in AAE is assumed to outpace increases in the AWE. For 2008 and thereafter, the AAE is increased at the same rate as for the AWE.

The assumed increase in AAE and in the proportions of earners results in projected average annual real increases in total employment earnings of about 1.7% for the period 2004 to 2020. This decreases to about 1.5% ultimately, reflecting the 1.2% real increase in annual wages and the 0.3% annual growth in the working-age population.

4. Rates of Return on Investments

The assets of the Canada Pension Plan consist of three components, as follows:

- the Account, which corresponds to three months of benefit payments;
- the Fund, which consists of 20-year loans to the provinces; and
- the assets invested by the CPP Investment Board.

The CPP Account and Fund assets held by the federal Department of Finance will be transferred to the CPP Investment Board beginning in the year 2004. The transfer of the Fund began in May 2004 and will take three years to complete. The transfer of the Account began in September 2004 and will take one year to complete.

The real rates of return are the excess of the nominal rates of return over the rates of price increase. For the Account component, which mainly consists of short-term investments, the real rate of return is assumed at 0.5% for 2004 and 1.0% for 2005. For the Fund component, which mainly consists of provincial long-term bonds, an ultimate real rate of return of 3.25% on new bonds has been assumed. The assumed long-term real rate of return on CPP assets takes into account the asset mix of investments for the three components. The real rates of return on investments are net of administrative and investment expenses.

The initial real rate of return reflects recently observed yields for the first six months of 2004. For the period of 2005 to 2025, the real rates of return are slightly higher than the assumed ultimate real rate of return of 4.1% due to the higher returns assumed for the Fund component (see Table 44). The long-term level of the real rate of return on CPP assets is in line with historical yields for large pension plans. Table 3 summarizes the main economic and investment assumptions over the projection period.

Table 3 Economic and Investment Assumptions

				Labour Force				
Year	Real Increase Average Annual Earnings	Real Increase Average Weekly Earnings	Price Increase	Participation Rate	Job Creation Rate	Unemployment Rate	Labour Force Annual Increase	Real Rate of Return on Investments
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2004	0.1	(0.3)	2.0	67.4	1.2	7.6	1.1	4.4
2005	0.3	0.2	2.0	67.3	1.1	7.6	1.1	5.0
2006	0.5	0.4	2.0	67.2	1.1	7.6	1.0	5.0
2007	0.7	0.6	2.0	67.0	1.0	7.5	0.9	4.8
2008	0.8	0.8	2.0	66.8	1.0	7.3	0.8	4.7
2009	0.9	0.9	2.1	66.6	0.9	7.3	0.8	4.5
2010	1.0	1.0	2.2	66.4	0.9	7.2	0.8	4.4
2011	1.1	1.1	2.3	66.2	0.8	7.2	0.8	4.3
2012	1.2	1.2	2.4	66.0	0.8	7.1	0.7	4.2
2013	1.2	1.2	2.5	65.8	0.7	7.0	0.6	4.2
2014	1.2	1.2	2.6	65.6	0.7	6.8	0.5	4.2
2015	1.2	1.2	2.7	65.4	0.6	6.7	0.5	4.2
2020	1.2	1.2	2.7	64.2	0.3	6.5	0.3	4.2
2025	1.2	1.2	2.7	62.4	0.1	6.5	0.1	4.1
2030	1.2	1.2	2.7	61.1	0.2	6.5	0.2	4.1
2040	1.2	1.2	2.7	60.0	0.3	6.5	0.3	4.1
2050	1.2	1.2	2.7	59.4	0.1	6.5	0.1	4.1

D. Other Assumptions

This report includes several other assumptions, such as the retirement rates and the disability incidence rates.

1. Retirement Rates

The sex-distinct retirement rates for any given age between 60 and 70 correspond to the number of emerging retirement beneficiaries divided by the product of the population and the retirement benefit eligibility rates for the given age.

The normal retirement age under the Canada Pension Plan is 65. However, since 1987 a person can choose to receive a reduced retirement pension as early as age 60. This provision has lowered the average age at benefit uptake from 65.2 in 1986 to 62.1 in 2003.

There exists a relationship between retirement rates and labour force participation rates in the age group 60 to 64. In this report, it is assumed that the participation rate for males aged 60 to 64 will increase from 53% in 2004 to 56% in 2030 while for females the increase, over the same period, is from 32% to 36%. In light of this, retirement rates at age 60 are adjusted downward by one-third of the increase in participation rates for ages

60 to 64 between 2004 and 2030 while retirement rates at age 65 are increased by the same amount.

Retirement rates in 2004 at age 60 are 33% and 40% for males and females, respectively. These rates are thus assumed to gradually decrease to reach levels of 32% and 38% in 2030 for males and females, respectively. The retirement rates are then held constant for 2030 and thereafter.

2. Disability Incidence Rates

The sex-distinct disability incidence rates at any given age are the number of new disability beneficiaries divided by the total number of people eligible for the disability benefit. Based on the historical Plan experience, the ultimate overall incidence rates for years 2008 and thereafter have been assumed at 3.25 per thousand eligible for males and at 3.50 per thousand eligible for females. These rates are not directly comparable to the Eighteenth CPP Actuarial Report assumed incidence rates since the methodology has been changed (refer to Appendix B, section V-E).

The assumption recognizes in part that incidence rates have significantly declined since 1992. However, the rate of decline has slowed down since 1998 and there has been a slight increase over the last few years. The assumption also recognizes that the overall incidence rate for females has recently been somewhat higher than for males.

IV. Results

A. Overview

The results of the actuarial projections of the financial status of the Canada Pension Plan presented in this report are generally consistent with the trends revealed in the previous triennial actuarial report. The key observations and findings are as follows.

- Demographic changes will have a major impact on the ratio of workers to retirees; the ratio of the number of people aged 20 to 64 to those aged 65 and over is expected to fall from about 4.9 in 2004 to 2.3 in 2050.
- The pay-as-you-go rate is expected to increase steadily from 8.3% in 2004 to 11.3% by 2050, mainly driven by the retirement of the baby boom generation.
- The steady-state contribution rate, which is the lowest rate sufficient to sustain the Plan without further increase, is 9.8% of contributory earnings. This rate is the same as presented in the previous actuarial report and 0.1% lower than the legislated 9.9% contribution rate.
- With the 9.9% legislated contribution rate, the assets are expected to increase significantly over the next 17 years, with the ratio of assets to the following year's expenditures growing from 3.1 in 2004 to 5.6 by 2021.
- Total assets are expected to grow from $68 billion at the end of 2003 to $147 billion by the end of 2010.
- As a result of Bill C-3, total assets under the management of the CPP Investment Board is expected to grow from $31 billion, which represents 46% of total assets in 2003, to $109 billion (100% of total assets) by the end of 2007.

B. Contributions

Projected contributions are the product of the contribution rate, the number of contributors and the average contributory earnings. The contribution rate is set by law and is 9.9% for 2004 and thereafter.

The number of contributors by age and sex is directly linked to the assumed labour force participation rates applied to the projected working-age population, and the job creation rates. Hence, the demographic and economic assumptions described in the preceding sections have a great influence on the expected level of contributions. In this report, the number of CPP contributors increases continually throughout the projection period from 11.7 million in 2004 to 13.8 million by 2025, after which the increases are limited due to the lower growth in the working age population and labour force. The growth in contributory earnings, which are derived by subtracting the Year's Basic Exemption (YBE) from pensionable earnings, is linked to the growth in average employment earnings through the assumption regarding annual increases in wages and is affected by the freeze on the YBE since 1998. The projected average contributory earnings in 2004 are $26,325 for men and $21,805 for women.

Contributions are expected to be $28.6 billion in 2004 and since the legislated contribution rate is constant at 9.9% for years 2004 and thereafter, contributions increase at the same rate as the total contributory earnings over the projection period. Table 4 presents the projected components of total contributions.

Table 4 Contributions

Year	Contribution Rate	Number of Contributors	Contributory Earnings	Contributions
	(%)	(thousands)	($ million)	($ million)
2004	9.9	11,716	288,970	28,608
2005	9.9	11,871	298,643	29,566
2006	9.9	12,028	309,772	30,667
2007	9.9	12,172	322,095	31,887
2008	9.9	12,317	335,376	33,202
2009	9.9	12,455	349,556	34,606
2010	9.9	12,596	364,926	36,128
2015	9.9	13,194	460,396	45,579
2020	9.9	13,609	581,181	57,537
2025	9.9	13,790	718,640	71,145
2030	9.9	14,040	888,999	88,011
2040	9.9	14,764	1,376,157	136,240
2050	9.9	15,284	2,097,524	207,655

C. Expenditures

The projected number of total beneficiaries by type of benefit is given in Table 5, while Table 6 presents the same information for males and females separately.

The number of retirement, disability and survivor beneficiaries increases throughout the projection period. In particular, due to the aging of the population, the number of retirement beneficiaries is expected to more than double over the next 25 years. In 2004, there are 2% fewer female retirement beneficiaries than male retirement beneficiaries, but by 2006 the numbers are equal and by 2050 the females outnumber the males by 15%. Over the same period, the number of disability and survivor beneficiaries increases but at a much slower pace than retirement beneficiaries.

Tables 7 and 8 show the amounts of projected expenditures by type. Projected expenditures in 2004 are $23.9 billion and reach $31.9 billion in 2010. Table 9 shows the projected expenditures by type expressed as a percentage of contributory earnings. They are referred to as the pay-as-you-go rates. The pay-as-you-go rate is expected to increase significantly from its current level of 8.3% in 2004 to 11.3% by the end of the projection period.

Table 5 Beneficiaries
(thousands)

Year	Retirement*	Disability	Survivor**	Children	Death***
2004	3,152	344	1,008	224	113
2005	3,254	351	1,030	224	117
2006	3,366	360	1,051	224	120
2007	3,500	369	1,071	225	124
2008	3,642	378	1,091	225	127
2009	3,784	387	1,111	225	131
2010	3,930	397	1,130	224	135
2015	4,792	429	1,222	223	154
2020	5,748	455	1,321	226	175
2025	6,747	462	1,438	236	201
2030	7,550	457	1,579	249	231
2040	8,437	499	1,879	266	293
2050	9,090	526	2,069	264	329

* The number given for retirement beneficiaries does not take into account that the retirement pension can be shared between spouses.

** A beneficiary who receives concurrently a retirement and a survivor pension are counted in each category.

*** This is the number of deceased contributors giving entitlement to a death benefit during the given year.

Table 6 Beneficiaries by Sex
(thousands)

	Males				Females			
Year	Retirement*	Disability	Survivor**	Death***	Retirement*	Disability	Survivor**	Death***
2004	1,593	170	152	75	1,559	175	856	39
2005	1,636	172	158	76	1,618	180	872	40
2006	1,684	175	164	78	1,682	185	887	42
2007	1,742	178	170	79	1,758	191	902	44
2008	1,805	182	176	81	1,837	196	916	46
2009	1,868	186	182	83	1,917	201	929	48
2010	1,932	190	188	85	1,998	207	942	50
2015	2,321	204	218	94	2,470	225	1,005	60
2020	2,756	216	249	105	2,992	239	1,071	70
2025	3,215	219	282	118	3,531	243	1,156	82
2030	3,578	215	315	135	3,972	242	1,265	96
2040	3,938	234	363	165	4,499	265	1,516	128
2050	4,220	246	381	180	4,870	280	1,688	148

* The number given for retirement beneficiaries does not take into account that the retirement pension can be shared between spouses.

** A beneficiary who receives concurrently a retirement and a survivor pension are counted in each category.

*** This is the number of deceased contributors giving entitlement to a death benefit during the given year.

Table 7 Expenditures
($ million)

Year	Retirement	Disability	Survivor	Children	Death	Administrative Expenses	Total
2004	16,534	2,939	3,293	475	252	402	23,895
2005	17,350	3,050	3,405	484	262	416	24,967
2006	18,239	3,175	3,514	493	272	431	26,124
2007	19,246	3,315	3,618	503	283	447	27,412
2008	20,367	3,458	3,714	513	294	464	28,810
2009	21,548	3,614	3,819	522	305	483	30,292
2010	22,801	3,786	3,930	532	316	503	31,868
2011	24,172	3,956	4,044	543	327	524	33,567
2012	25,739	4,100	4,157	554	338	548	35,437
2013	27,463	4,261	4,279	567	350	572	37,491
2014	29,289	4,438	4,408	579	361	598	39,674
2015	31,254	4,630	4,546	594	372	625	42,022
2016	33,369	4,834	4,693	610	383	654	44,542
2017	35,616	5,045	4,845	627	395	683	47,212
2018	38,020	5,257	5,004	646	407	713	50,046
2019	40,593	5,464	5,171	666	419	743	53,056
2020	43,342	5,672	5,346	687	432	774	56,253
2021	46,254	5,885	5,534	710	444	805	59,632
2022	49,319	6,094	5,733	735	456	838	63,175
2023	52,554	6,303	5,948	761	470	871	66,907
2024	55,951	6,513	6,177	789	483	906	70,820
2025	59,486	6,716	6,425	819	498	942	74,887
2026	63,123	6,919	6,693	850	513	980	79,078
2027	66,825	7,129	6,981	882	528	1,021	83,366
2028	70,619	7,338	7,292	916	544	1,063	87,772
2029	74,521	7,563	7,626	952	560	1,106	92,328
2030	78,493	7,820	7,984	989	577	1,152	97,015
2031	82,502	8,129	8,366	1,027	593	1,201	101,817
2032	86,528	8,479	8,774	1,066	609	1,252	106,708
2033	90,618	8,849	9,207	1,105	626	1,305	111,710
2034	94,832	9,233	9,664	1,145	642	1,361	116,877
2035	99,212	9,625	10,147	1,184	658	1,420	122,246
2040	123,497	12,004	12,910	1,382	731	1,754	152,278
2045	154,279	14,839	16,174	1,577	787	2,157	189,813
2050	193,987	17,779	19,844	1,787	821	2,639	236,858
2055	243,646	21,184	23,934	2,041	835	3,227	294,867
2060	304,728	25,051	28,703	2,361	842	3,956	365,642
2065	376,514	30,200	34,639	2,756	854	4,873	449,836
2070	462,197	37,201	42,204	3,206	875	6,017	551,701
2075	569,383	45,793	51,575	3,695	897	7,415	678,758

Table 8 Expenditures - (millions of 2004 constant dollars)[1]

Year	Retirement	Disability	Survivor	Children	Death	Administrative Expenses	Total
2004	16,534	2,938	3,293	475	252	402	23,895
2005	17,024	2,993	3,341	475	257	408	24,497
2006	17,545	3,054	3,381	474	262	415	25,130
2007	18,151	3,125	3,412	474	267	422	25,852
2008	18,831	3,197	3,434	474	272	429	26,638
2009	19,533	3,277	3,462	473	276	438	27,459
2010	20,247	3,362	3,490	472	281	447	28,298
2011	21,005	3,438	3,514	472	284	455	29,170
2012	21,868	3,483	3,532	471	287	466	30,107
2013	22,789	3,536	3,551	470	290	475	31,111
2014	23,715	3,593	3,569	469	292	484	32,124
2015	24,669	3,655	3,588	469	294	493	33,168
2016	25,650	3,716	3,607	468	294	503	34,239
2017	26,658	3,776	3,627	469	296	511	35,337
2018	27,709	3,831	3,647	472	297	520	36,473
2019	28,806	3,877	3,670	473	297	527	37,650
2020	29,948	3,919	3,694	475	299	535	38,870
2021	31,120	3,959	3,723	478	299	542	40,121
2022	32,310	3,992	3,756	482	299	549	41,387
2023	33,524	4,021	3,794	485	300	556	42,680
2024	34,753	4,046	3,837	490	300	563	43,988
2025	35,977	4,062	3,886	495	301	570	45,292
2026	37,173	4,075	3,941	501	302	577	46,569
2027	38,319	4,088	4,004	506	303	585	47,804
2028	39,430	4,097	4,071	511	304	594	49,007
2029	40,514	4,112	4,146	518	304	601	50,195
2030	41,552	4,140	4,226	524	305	610	51,357
2031	42,526	4,190	4,312	529	306	619	52,482
2032	43,429	4,256	4,404	535	306	628	53,557
2033	44,286	4,325	4,500	540	306	638	54,593
2034	45,127	4,394	4,599	544	306	648	55,617
2035	45,970	4,460	4,702	549	305	658	56,643
2040	50,086	4,868	5,236	560	296	711	61,758
2045	54,766	5,268	5,741	560	279	766	67,380
2050	60,273	5,524	6,166	555	255	820	73,594
2055	66,261	5,761	6,509	555	227	878	80,191
2060	72,537	5,963	6,832	562	200	942	87,037
2065	78,447	6,292	7,217	574	178	1,015	93,724
2070	84,289	6,784	7,697	585	160	1,097	100,611
2075	90,886	7,309	8,232	590	143	1,184	108,344

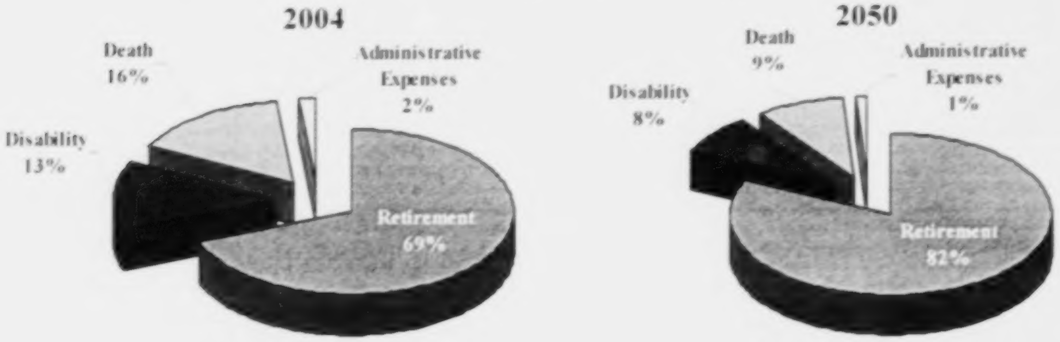
(1) For a given year, the value in 2004 constant dollars is equal to the corresponding value in current dollars divided by the cumulative index of the indexation rates for benefits provided for as of 2004 in the projections.

Table 9 Expenditures as Percentage of Contributory Earnings
(pay-as-you-go rates)

Year	Retirement	Disability	Survivor	Children	Death	Administrative Expenses	Total
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2004	5.72	1.02	1.14	0.16	0.09	0.14	8.27
2005	5.81	1.02	1.14	0.16	0.09	0.14	8.36
2006	5.89	1.02	1.13	0.16	0.09	0.14	8.43
2007	5.98	1.03	1.12	0.16	0.09	0.14	8.51
2008	6.07	1.03	1.11	0.15	0.09	0.14	8.59
2009	6.16	1.03	1.09	0.15	0.09	0.14	8.67
2010	6.25	1.04	1.08	0.15	0.09	0.14	8.73
2011	6.34	1.04	1.06	0.14	0.09	0.14	8.81
2012	6.45	1.03	1.04	0.14	0.08	0.14	8.88
2013	6.57	1.02	1.02	0.14	0.08	0.14	8.97
2014	6.68	1.01	1.00	0.13	0.08	0.14	9.04
2015	6.79	1.01	0.99	0.13	0.08	0.14	9.13
2016	6.90	1.00	0.97	0.13	0.08	0.14	9.22
2017	7.02	0.99	0.96	0.12	0.08	0.13	9.31
2018	7.16	0.99	0.94	0.12	0.08	0.13	9.42
2019	7.30	0.98	0.93	0.12	0.08	0.13	9.55
2020	7.46	0.98	0.92	0.12	0.07	0.13	9.68
2021	7.62	0.97	0.91	0.12	0.07	0.13	9.83
2022	7.79	0.96	0.91	0.12	0.07	0.13	9.98
2023	7.96	0.95	0.90	0.12	0.07	0.13	10.13
2024	8.12	0.95	0.90	0.11	0.07	0.13	10.27
2025	8.28	0.93	0.89	0.11	0.07	0.13	10.42
2026	8.42	0.92	0.89	0.11	0.07	0.13	10.55
2027	8.54	0.91	0.89	0.11	0.07	0.13	10.66
2028	8.65	0.90	0.89	0.11	0.07	0.13	10.75
2029	8.75	0.89	0.90	0.11	0.07	0.13	10.84
2030	8.83	0.88	0.90	0.11	0.06	0.13	10.91
2031	8.89	0.88	0.90	0.11	0.06	0.13	10.97
2032	8.92	0.87	0.90	0.11	0.06	0.13	11.00
2033	8.95	0.87	0.91	0.11	0.06	0.13	11.03
2034	8.96	0.87	0.91	0.11	0.06	0.13	11.04
2035	8.97	0.87	0.92	0.11	0.06	0.13	11.06
2040	8.97	0.87	0.94	0.10	0.05	0.13	11.07
2045	9.05	0.87	0.95	0.09	0.05	0.13	11.14
2050	9.25	0.85	0.95	0.09	0.04	0.13	11.29
2055	9.45	0.82	0.93	0.08	0.03	0.13	11.44
2060	9.60	0.79	0.90	0.07	0.03	0.12	11.52
2065	9.60	0.77	0.88	0.07	0.02	0.12	11.47
2070	9.52	0.77	0.87	0.07	0.02	0.12	11.36
2075	9.49	0.76	0.86	0.06	0.02	0.12	11.32

It is interesting to compare the relative change in the distribution of expenditures by type of event over the projection period. Chart 4 presents the distribution of expenditures for 2004 and 2050. The increasing proportion of retirement benefits, which rises from 69% in 2004 to 82% in 2050, clearly shows the impact of the aging population on the benefits paid by the Canada Pension Plan.

Chart 4 Distribution of Expenditures by Type of Event



D. Asset Projections

1. Asset Projections at Market Value

Historically, CPP assets have been presented at cost value because they have been traditionally limited to short-term investments for the Account component and 20-year bonds for the Fund component (i.e. loans to provinces). Since the creation of the CPP Investment Board in 1998, excess cash flows are invested in the capital markets. Those assets, as is the case for private pension plans, are usually valued at market.

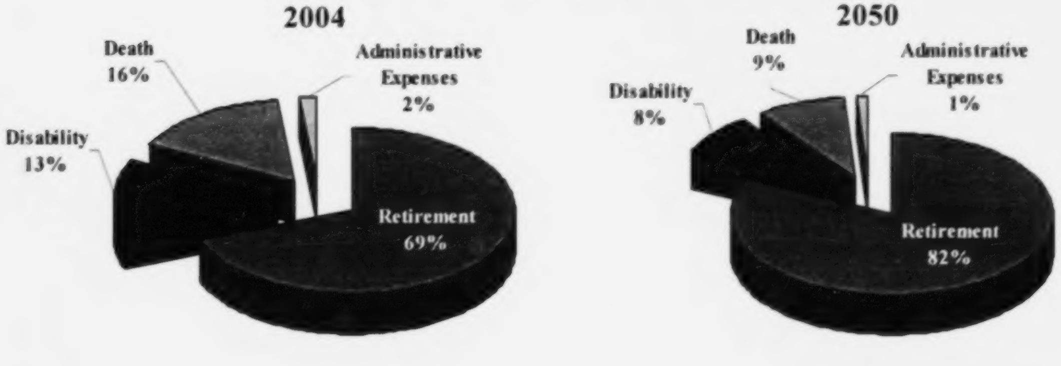
The new investment policies make it more realistic to use a market value approach in projecting assets, especially as the proportion of assets under the CPP Investment Board is expected to grow to 100% by the end of 2007. For this purpose and for consistency with the methodology used in large private pension plans and in the Québec Pension Plan actuarial report, the financial projections of assets are now valued at market. The market value of assets is $67,614 million as at 31 December 2003. Note that this is higher than the $64,028 million presented in the historical results of Table 10 for year 2003. This is because the Fund component for year 2003 is now valued on a market value basis as opposed to a cost accrual basis.

2. Projected Financial Status

Table 10 presents historical results while Tables 11 and 12 show, respectively, in current dollars and in 2004 constant dollars, the projected financial status of the CPP, using the legislated contribution rate of 9.9% for years 2004 and thereafter. The projection of assets using the steady-state contribution rate of 9.8% for years 2007 and thereafter is discussed in subsection 3 and the detailed financial projections are presented in Appendix F.

It is interesting to compare the relative change in the distribution of expenditures by type of event over the projection period. Chart 4 presents the distribution of expenditures for 2004 and 2050. The increasing proportion of retirement benefits, which rises from 69% in 2004 to 82% in 2050, clearly shows the impact of the aging population on the benefits paid by the Canada Pension Plan.

Chart 4 Distribution of Expenditures by Type of Event



D. Asset Projections

1. Asset Projections at Market Value

Historically, CPP assets have been presented at cost value because they have been traditionally limited to short-term investments for the Account component and 20-year bonds for the Fund component (i.e. loans to provinces). Since the creation of the CPP Investment Board in 1998, excess cash flows are invested in the capital markets. Those assets, as is the case for private pension plans, are usually valued at market.

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Table 10 Historical Results
($ million)

Year	Paygo Rate*	Contribution Rate	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.	Yield	Asset/ Expenditure Ratio
	(%)	(%)						(%)	
1966	0.05	3.6	531	8	523	5	525	0.7	52.47
1967	0.06	3.6	623	10	614	37	1,175	4.3	48.98
1968	0.14	3.6	686	24	662	79	1,916	5.2	35.49
1969	0.29	3.6	737	54	683	128	2,727	5.6	28.12
1970	0.49	3.6	773	97	676	193	3,596	6.2	24.14
1971	0.69	3.6	816	149	666	260	4,523	6.6	21.33
1972	0.90	3.6	869	212	657	333	5,513	6.8	19.83
1973	1.08	3.6	939	278	661	406	6,578	6.9	16.78
1974	1.24	3.6	1,203	392	812	497	7,887	7.1	14.06
1975	1.50	3.6	1,426	561	865	608	9,359	7.3	11.47
1976	1.90	3.6	1,630	816	815	746	10,920	7.6	10.48
1977	2.17	3.6	1,828	1,042	786	889	12,596	7.8	9.72
1978	2.38	3.6	2,022	1,296	727	1,043	14,365	8.0	9.03
1979	2.54	3.6	2,317	1,590	727	1,235	16,328	8.3	8.31
1980	2.79	3.6	2,604	1,965	638	1,467	18,433	8.8	7.64
1981	2.94	3.6	3,008	2,413	595	1,785	20,812	9.5	7.03
1982	3.30	3.6	3,665	2,958	707	2,160	23,679	10.1	6.58
1983	3.70	3.6	3,474	3,598	(124)	2,494	26,049	10.5	6.22
1984	3.87	3.6	4,118	4,185	(67)	2,829	28,811	10.8	5.97
1985	4.02	3.6	4,032	4,826	(795)	3,114	31,130	10.9	5.66
1986	4.16	3.6	4,721	5,503	(782)	3,395	33,743	11.0	4.73
1987	5.08	3.8	5,393	7,130	(1,736)	3,653	35,660	11.0	4.31
1988	5.49	4.0	6,113	8,272	(2,159)	3,885	37,387	11.2	3.98
1989	5.76	4.2	6,694	9,391	(2,698)	4,162	38,852	11.5	3.72
1990	6.08	4.4	7,889	10,438	(2,549)	4,387	40,689	11.6	3.53
1991	6.54	4.6	8,396	11,518	(3,122)	4,476	42,043	11.3	3.22
1992	7.23	4.8	8,883	13,076	(4,193)	4,498	42,347	11.1	2.97
1993	7.72	5.0	9,166	14,273	(5,106)	4,479	41,720	11.1	2.72
1994	8.02	5.2	9,585	15,362	(5,778)	4,404	40,346	11.2	2.52
1995	8.09	5.4	10,911	15,986	(5,075)	4,411	39,683	11.5	2.37
1996	8.28	5.6	10,757	16,723	(5,966)	4,178	37,894	11.2	2.15
1997	8.30	6.0	12,165	17,570	(5,405)	3,971	36,460	11.1	1.97
1998	8.19	6.4	14,473	18,338	(3,865)	3,938	36,535	11.2	1.94
1999	8.05	7.0	16,052	18,877	(2,825)	3,845	37,554	10.7	1.91
2000	8.01	7.8	19,977	19,683	294	3,747	41,595	9.7	2.02
2001**	7.85	8.6	22,469	20,515	1,954	2,628	48,272	5.7	2.23
2002**	8.16	9.4	24,955	21,666	3,289	227	51,788	0.5	2.28
2003**	8.19	9.9	27,454	22,716	4,738	7,502	64,028	13.6	2.68

* The pay-as-you-go rates have been calculated using the historical contributory earnings while the contributions are based on an estimate made by the Department of Finance.

** Results for years 1966 to 2000 are on a cash basis, while results for years 2001 to 2003 are presented on a cost accrual basis with CPPIB assets valued at market. If assets were shown at market value at the end of 2003, total assets would be $67,614 million instead of $64,028 million.

Table 11 Financial Status
($ million)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*	Yield	Asset/ Expenditure Ratio
	(%)	(%)							(%)	
2004	8.27	9.9	288,970	28,608	23,895	4,713	4,530	76,857	6.43	3.08
2005	8.36	9.9	298,643	29,566	24,967	4,599	5,565	87,021	7.00	3.33
2006	8.43	9.9	309,772	30,667	26,124	4,543	6,294	97,858	7.02	3.57
2007	8.51	9.9	322,095	31,887	27,412	4,475	6,865	109,198	6.83	3.79
2008	8.59	9.9	335,376	33,202	28,810	4,392	7,460	121,050	6.67	4.00
2009	8.67	9.9	349,556	34,606	30,292	4,314	8,188	133,553	6.62	4.19
2010	8.73	9.9	364,926	36,128	31,868	4,260	8,982	146,795	6.60	4.37
2011	8.81	9.9	381,122	37,731	33,567	4,164	9,841	160,800	6.59	4.54
2012	8.88	9.9	399,171	39,518	35,437	4,081	10,839	175,720	6.64	4.69
2013	8.97	9.9	418,003	41,382	37,491	3,891	11,992	191,603	6.74	4.83
2014	9.04	9.9	438,749	43,436	39,674	3,762	13,258	208,623	6.84	4.96
2015	9.13	9.9	460,396	45,579	42,022	3,557	14,635	226,815	6.95	5.09
2016	9.22	9.9	483,344	47,851	44,542	3,309	15,891	246,015	6.95	5.21
2017	9.31	9.9	507,310	50,224	47,212	3,012	17,203	266,229	6.94	5.32
2018	9.42	9.9	531,212	52,590	50,046	2,544	18,585	287,359	6.94	5.42
2019	9.55	9.9	555,717	55,016	53,056	1,960	20,016	309,335	6.94	5.50
2020	9.68	9.9	581,181	57,537	56,253	1,284	21,497	332,116	6.93	5.57
2021	9.83	9.9	606,726	60,066	59,632	434	23,036	355,585	6.93	5.63
2022	9.98	9.9	633,199	62,687	63,175	(488)	24,526	379,624	6.90	5.67
2023	10.13	9.9	660,470	65,387	66,907	(1,520)	26,055	404,158	6.88	5.71
2024	10.27	9.9	689,301	68,241	70,820	(2,579)	27,598	429,177	6.86	5.73
2025	10.42	9.9	718,640	71,145	74,887	(3,742)	29,177	454,613	6.83	5.75
2026	10.55	9.9	749,328	74,183	79,078	(4,895)	30,771	480,489	6.81	5.76
2027	10.66	9.9	782,108	77,429	83,366	(5,937)	32,499	507,051	6.81	5.78
2028	10.75	9.9	816,109	80,795	87,772	(6,977)	34,274	534,348	6.82	5.79
2029	10.84	9.9	852,033	84,351	92,328	(7,977)	36,079	562,450	6.81	5.80
2030	10.91	9.9	888,999	88,011	97,015	(9,004)	37,958	591,404	6.81	5.81
2031	10.97	9.9	928,021	91,874	101,817	(9,943)	39,898	621,359	6.81	5.82
2032	11.00	9.9	969,672	95,998	106,708	(10,710)	41,912	652,560	6.81	5.84
2033	11.03	9.9	1,012,946	100,282	111,710	(11,428)	44,010	685,143	6.81	5.86
2034	11.04	9.9	1,058,322	104,774	116,877	(12,103)	46,204	719,243	6.81	5.88
2035	11.06	9.9	1,105,734	109,468	122,246	(12,778)	48,500	754,965	6.81	5.91
2040	11.07	9.9	1,376,157	136,240	152,278	(16,038)	61,823	962,443	6.81	6.05
2045	11.14	9.9	1,704,048	168,701	189,813	(21,112)	78,825	1,226,867	6.81	6.18
2050	11.29	9.9	2,097,524	207,655	236,858	(29,203)	99,894	1,553,781	6.81	6.28
2055	11.44	9.9	2,578,617	255,283	294,867	(39,584)	125,573	1,952,041	6.81	6.34
2060	11.52	9.9	3,174,429	314,268	365,642	(51,374)	156,849	2,437,440	6.81	6.39
2065	11.47	9.9	3,923,366	388,413	449,836	(61,423)	196,026	3,047,388	6.81	6.50
2070	11.36	9.9	4,856,127	480,757	551,701	(70,944)	246,821	3,839,635	6.81	6.68
2075	11.32	9.9	5,997,855	593,788	678,758	(84,970)	313,035	4,871,724	6.81	6.88

* All asset components are valued at market.

Table 12 Financial Status - (millions of 2004 constant dollars)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*
	(%)	(%)						
2004	8.27	9.9	288,970	28,608	23,895	4,713	4,530	76,857
2005	8.36	9.9	293,027	29,010	24,497	4,512	5,461	85,384
2006	8.43	9.9	297,987	29,501	25,130	4,371	6,054	94,135
2007	8.51	9.9	303,766	30,073	25,852	4,221	6,474	102,984
2008	8.59	9.9	310,089	30,699	26,638	4,061	6,898	111,923
2009	8.67	9.9	316,863	31,369	27,459	3,911	7,423	121,062
2010	8.73	9.9	324,043	32,080	28,298	3,782	7,976	130,349
2011	8.81	9.9	331,193	32,788	29,170	3,619	8,552	139,734
2012	8.88	9.9	339,133	33,574	30,107	3,467	9,209	149,290
2013	8.97	9.9	346,864	34,340	31,111	3,229	9,951	158,994
2014	9.04	9.9	355,256	35,170	32,124	3,046	10,735	168,922
2015	9.13	9.9	363,395	35,976	33,168	2,808	11,552	179,027
2016	9.22	9.9	371,537	36,782	34,239	2,544	12,215	189,107
2017	9.31	9.9	379,707	37,591	35,337	2,254	12,876	199,265
2018	9.42	9.9	387,144	38,327	36,473	1,854	13,545	209,425
2019	9.55	9.9	394,356	39,041	37,650	1,391	14,204	219,514
2020	9.68	9.9	401,583	39,757	38,870	887	14,854	229,485
2021	9.83	9.9	408,213	40,413	40,121	292	15,499	239,242
2022	9.98	9.9	414,824	41,068	41,387	(320)	16,068	248,700
2023	10.13	9.9	421,314	41,710	42,680	(970)	16,620	257,813
2024	10.27	9.9	428,145	42,386	43,988	(1,602)	17,142	266,575
2025	10.42	9.9	434,634	43,029	45,292	(2,263)	17,646	274,950
2026	10.55	9.9	441,279	43,687	46,569	(2,882)	18,121	282,960
2027	10.66	9.9	448,475	44,399	47,804	(3,405)	18,635	290,752
2028	10.75	9.9	455,668	45,111	49,007	(3,896)	19,137	298,349
2029	10.84	9.9	463,219	45,859	50,195	(4,337)	19,615	305,784
2030	10.91	9.9	470,610	46,590	51,357	(4,767)	20,094	313,072
2031	10.97	9.9	478,352	47,357	52,482	(5,125)	20,566	320,282
2032	11.00	9.9	486,680	48,181	53,557	(5,376)	21,036	327,521
2033	11.03	9.9	495,034	49,008	54,593	(5,585)	21,508	334,834
2034	11.04	9.9	503,612	49,858	55,617	(5,759)	21,986	342,258
2035	11.06	9.9	512,340	50,722	56,643	(5,921)	22,473	349,812
2040	11.07	9.9	558,115	55,253	61,758	(6,505)	25,073	390,329
2045	11.14	9.9	604,903	59,885	67,380	(7,494)	27,981	435,513
2050	11.29	9.9	651,716	64,520	73,594	(9,074)	31,038	482,771
2055	11.44	9.9	701,272	69,426	80,191	(10,765)	34,150	530,870
2060	11.52	9.9	755,636	74,808	87,037	(12,229)	37,336	580,205
2065	11.47	9.9	817,436	80,926	93,724	(12,797)	40,842	634,926
2070	11.36	9.9	885,591	87,673	100,611	(12,938)	45,012	700,218
2075	11.32	9.9	957,386	94,781	108,344	(13,563)	49,967	777,631

* All asset components are valued at market.

Table 13 presents the net cash flow, investment earnings and assets by component, namely the Account, the Fund (federal and provincial bonds) and the assets under the management of the CPP Investment Board.

Assets increase significantly over the next 17 years, from $77 billion in 2004 to $356 billion in 2021. Contributions and investment earnings are projected to be 40% higher than expenditures over that period. Thereafter, revenues continue to be higher than expenditures but to a lesser extent. This causes the assets to grow at a much slower pace. The assets reach a level of $1,554 billion by 2050. Table 14 shows in more detail the sources of the cash required to cover the expenditures.

From Table 14, several conclusions can be drawn.

- The assets grow continuously over the projection period. During the period 2004 to 2021, contributions are more than sufficient to cover expenditures.
- From 2022 onward, some of the investment earnings are required to fund net cash outflows. In 2050, 29% of investment earnings are required to pay for benefits.
- Investment earnings, which represent 14% of revenues (i.e. contributions and investment earnings) in 2004, will represent 27% in 2020. In 2050, investment earnings represent 32% of revenues. This clearly illustrates the importance of investment earnings as a source of revenues to the Plan.

Chart 5 shows the distribution of cash flows by source for the period 1990 to 2025.

Chart 5 Distribution of Cash Flows by Source
(millions of 2004 constant dollars)

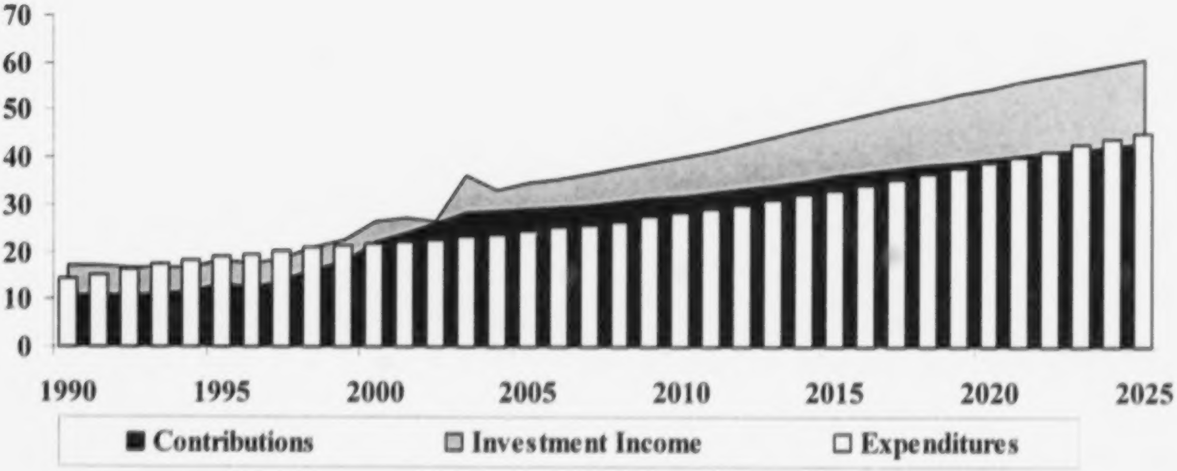


Table 13 Assets by Component - Using 9.9% Contribution Rate
($ billion)

		Investment Earnings				Assets*			
Year	Net Cash Flow	Account	Fund	CPPIB	Total	Account	Fund	CPPIB	Total
2004	4.7	0.1	2.5	1.9	4.5	4.1	22.0	50.8	76.9
2005	4.6	0.1	1.8	3.7	5.6	0.0	11.7	75.3	87.0
2006	4.5	0.0	0.9	5.4	6.3	0.0	2.6	95.2	97.9
2007	4.5	0.0	0.2	6.7	6.9	0.0	0.0	109.2	109.2
2008	4.4	0.0	0.0	7.5	7.5	0.0	0.0	121.1	121.1
2009	4.3	0.0	0.0	8.2	8.2	0.0	0.0	133.6	133.6
2010	4.3	0.0	0.0	9.0	9.0	0.0	0.0	146.8	146.8
2011	4.2	0.0	0.0	9.8	9.8	0.0	0.0	160.8	160.8
2012	4.1	0.0	0.0	10.8	10.8	0.0	0.0	175.7	175.7
2013	3.9	0.0	0.0	12.0	12.0	0.0	0.0	191.6	191.6
2014	3.8	0.0	0.0	13.3	13.3	0.0	0.0	208.6	208.6
2015	3.6	0.0	0.0	14.6	14.6	0.0	0.0	226.8	226.8
2016	3.3	0.0	0.0	15.9	15.9	0.0	0.0	246.0	246.0
2017	3.0	0.0	0.0	17.2	17.2	0.0	0.0	266.2	266.2
2018	2.5	0.0	0.0	18.6	18.6	0.0	0.0	287.4	287.4
2019	2.0	0.0	0.0	20.0	20.0	0.0	0.0	309.3	309.3
2020	1.3	0.0	0.0	21.5	21.5	0.0	0.0	332.1	332.1
2021	0.4	0.0	0.0	23.0	23.0	0.0	0.0	355.6	355.6
2022	(0.5)	0.0	0.0	24.5	24.5	0.0	0.0	379.6	379.6
2023	(1.5)	0.0	0.0	26.1	26.1	0.0	0.0	404.2	404.2
2024	(2.6)	0.0	0.0	27.6	27.6	0.0	0.0	429.2	429.2
2025	(3.7)	0.0	0.0	29.2	29.2	0.0	0.0	454.6	454.6
2026	(4.9)	0.0	0.0	30.8	30.8	0.0	0.0	480.5	480.5
2027	(5.9)	0.0	0.0	32.5	32.5	0.0	0.0	507.1	507.1
2028	(7.0)	0.0	0.0	34.3	34.3	0.0	0.0	534.3	534.3
2029	(8.0)	0.0	0.0	36.1	36.1	0.0	0.0	562.5	562.5
2030	(9.0)	0.0	0.0	38.0	38.0	0.0	0.0	591.4	591.4
2031	(9.9)	0.0	0.0	39.9	39.9	0.0	0.0	621.4	621.4
2032	(10.7)	0.0	0.0	41.9	41.9	0.0	0.0	652.6	652.6
2033	(11.4)	0.0	0.0	44.0	44.0	0.0	0.0	685.1	685.1
2034	(12.1)	0.0	0.0	46.2	46.2	0.0	0.0	719.2	719.2
2035	(12.8)	0.0	0.0	48.5	48.5	0.0	0.0	755.0	755.0
2040	(16.0)	0.0	0.0	61.8	61.8	0.0	0.0	962.4	962.4
2045	(21.1)	0.0	0.0	78.8	78.8	0.0	0.0	1,226.9	1,226.9
2050	(29.2)	0.0	0.0	99.9	99.9	0.0	0.0	1,553.8	1,553.8
2055	(39.6)	0.0	0.0	125.6	125.6	0.0	0.0	1,952.0	1,952.0
2060	(51.4)	0.0	0.0	156.8	156.8	0.0	0.0	2,437.4	2,437.4
2065	(61.4)	0.0	0.0	196.0	196.0	0.0	0.0	3,047.4	3,047.4
2070	(70.9)	0.0	0.0	246.8	246.8	0.0	0.0	3,839.6	3,839.6
2075	(85.0)	0.0	0.0	313.0	313.0	0.0	0.0	4,871.7	4,871.7

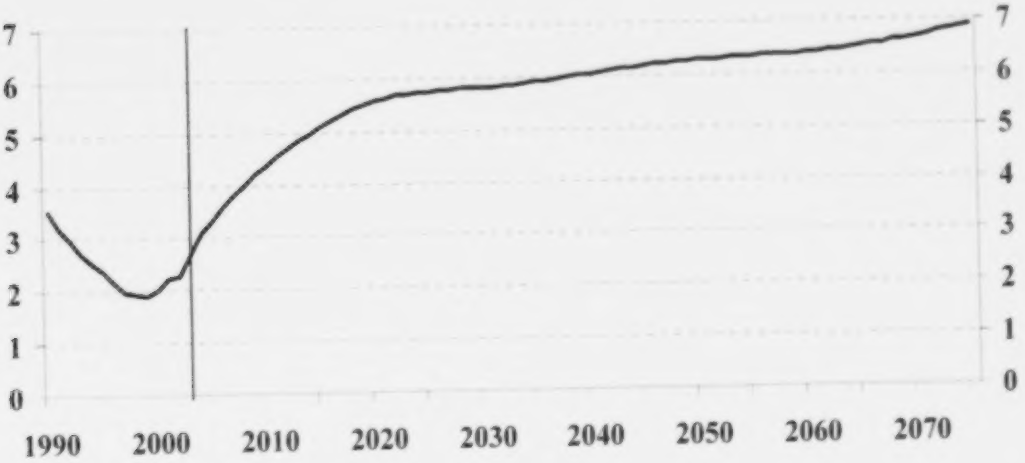
* All asset components are valued at market.

Table 14 Sources of Income and Funding of Expenditures
($ billion)

Year	Expenditures	Contributions	Shortfall	Investment Earnings	Shortfall as % of Investment Earnings	Total Assets
2004	23.9	28.6	0.0	4.5	0.0	76.9
2005	25.0	29.6	0.0	5.6	0.0	87.0
2006	26.1	30.7	0.0	6.3	0.0	97.9
2007	27.4	31.9	0.0	6.9	0.0	109.2
2008	28.8	33.2	0.0	7.5	0.0	121.1
2009	30.3	34.6	0.0	8.2	0.0	133.6
2010	31.9	36.1	0.0	9.0	0.0	146.8
2011	33.6	37.7	0.0	9.8	0.0	160.8
2012	35.4	39.5	0.0	10.8	0.0	175.7
2013	37.5	41.4	0.0	12.0	0.0	191.6
2014	39.7	43.4	0.0	13.3	0.0	208.6
2015	42.0	45.6	0.0	14.6	0.0	226.8
2016	44.5	47.9	0.0	15.9	0.0	246.0
2017	47.2	50.2	0.0	17.2	0.0	266.2
2018	50.0	52.6	0.0	18.6	0.0	287.4
2019	53.1	55.0	0.0	20.0	0.0	309.3
2020	56.3	57.5	0.0	21.5	0.0	332.1
2021	59.6	60.1	0.0	23.0	0.0	355.6
2022	63.2	62.7	0.5	24.5	2.0	379.6
2023	66.9	65.4	1.5	26.1	5.8	404.2
2024	70.8	68.2	2.6	27.6	9.3	429.2
2025	74.9	71.1	3.7	29.2	12.8	454.6
2026	79.1	74.2	4.9	30.8	15.9	480.5
2027	83.4	77.4	5.9	32.5	18.3	507.1
2028	87.8	80.8	7.0	34.3	20.4	534.3
2029	92.3	84.4	8.0	36.1	22.1	562.5
2030	97.0	88.0	9.0	38.0	23.7	591.4
2031	101.8	91.9	9.9	39.9	24.9	621.4
2032	106.7	96.0	10.7	41.9	25.6	652.6
2033	111.7	100.3	11.4	44.0	26.0	685.1
2034	116.9	104.8	12.1	46.2	26.2	719.2
2035	122.2	109.5	12.8	48.5	26.3	755.0
2040	152.3	136.2	16.0	61.8	25.9	962.4
2045	189.8	168.7	21.1	78.8	26.8	1,226.9
2050	236.9	207.7	29.2	99.9	29.2	1,553.8
2055	294.9	255.3	39.6	125.6	31.5	1,952.0
2060	365.6	314.3	51.4	156.8	32.8	2,437.4
2065	449.8	388.4	61.4	196.0	31.3	3,047.4
2070	551.7	480.8	70.9	246.8	28.7	3,839.6
2075	678.8	593.8	85.0	313.0	27.1	4,871.7

An important measure of the Plan's funding status is defined by the ratio of assets at the end of one year to the expenditures of the next. As can be seen in Chart 6, this ratio is projected to increase over the next two decades, reaching 5.6 by 2020. Thereafter it rises slowly to a value of 6.3 in 2050.

Chart 6 Asset/Expenditure Ratio
(9.9% contribution rate for 2004+)



The slowdown in the growth rate of the ratio from 2015 to 2035 results from the retirement of the baby boom generation, which increases the cash outflows of the Plan. The existence of a large pool of assets enables the Plan to absorb the increased outflow and to maintain the contribution rate at 9.9% without impairing the financial soundness of the Plan.

3. Steady-State Contribution Rate

Section 115 (1.1) (c) of the *Canada Pension Plan* describes the financing objective of having a contribution rate in 2007 and thereafter that is no lower than the lowest rate that will result in the ratio of the assets to the following year's expenditures remaining generally constant over the foreseeable future. The lowest contribution rate that will meet this objective is referred to as the steady-state contribution rate in this report.

The steady-state contribution rate is defined as the lowest level contribution rate applicable after the end of the review period, rounded to the nearest 0.1% that results in the asset/expenditure ratio being the same in the 10th and 60th year following the end of the review period. For this report, the end of the review period is 2006. Therefore, the steady-state contribution rate is applicable for years 2007 and thereafter and the relevant years for the determination of the steady-state contribution rate are 2016 and 2066.

The resulting steady-state contribution rate for this report was determined to be 9.8% for years 2007 and thereafter and is the same as for the previous report. Table 15 presents the elements of change in the steady-state contribution rate from the previous report.

Table 15 Steady-State Contribution Rate

	Steady-State Contribution Rate (%)
18th Report (Rounded)	**9.8**
18th Report (Unrounded)	**9.795**
Amendments	
-19th Report (Bill C-3)	**(0.033)**
-20th Report (Part 4 of Bill C-30)	**(0.012)**
Experience (2001 to 2003)	**(0.020)**
Changes in Methods	**0.034**
Changes in Demographic Assumptions	**0.036**
Changes in Economic Assumptions	**(0.005)**
Changes in Investment Assumptions	**0.028**
Changes in Benefit Assumptions	**(0.053)**
21st Report (Unrounded)	**9.770**
21st Report (Rounded)	**9.8**

The steady-state contribution rate required under subsection 115(1.1) (c) of the *Canada Pension Plan* is referred to by the default provisions in subsections 113.1(11.01) to 113.1(11.15). The default provisions may result in adjustments being made to the contribution rate and, perhaps, benefits in payment if the federal and provincial governments reach no agreement in response to the actuarial determination of a steady-state contribution rate. In respect of the current triennial review, the steady-state contribution rate is less than 9.9% and so the default provisions do not apply. Therefore, in the absence of specific action by the federal and provincial governments, the legislated contribution rate will remain at 9.9% for years 2004 and thereafter.

Table 16 compares the projected asset/expenditure ratio if either the legislated contribution rate of 9.9% or the 9.8% steady-state contribution rate is used. A detailed financial projection based on the steady-state contribution rate of 9.8% in 2007 and thereafter is shown in Appendix F of this report.

Table 16 Asset/Expenditure Ratio

Contribution Rate	2004	*2016*	2025	2050	*2066*	2075
9.9% (Statutory)	3.08	5.21	5.75	6.28	6.53	6.88
9.8% (Steady-State)	3.08	5.09*	5.53	5.62	5.40*	5.38

* These numbers are the same if the unrounded steady-state rate of 9.770% is used.

The steady-state contribution rate will be recalculated in connection with the next triennial actuarial report, to be prepared as at 31 December 2006. It may also be recalculated at any other date to reflect the cost impact of any proposed amendments to the Plan.

V. Sensitivity Analysis

A. Introduction

The future income and outgo of the Canada Pension Plan depend on many economic and demographic factors, including the labour force, average earnings, inflation, fertility, mortality, migration, retirement patterns and disability rates. The income will depend on how these factors affect the size and composition of the working-age population and the level and distribution of earnings. Similarly, the outgo will depend on how these factors affect the size and composition of the beneficiary population and the general level of benefits.

The projected long-term financial status of the Plan is based on best-estimate assumptions; the objective of this subsection is to present alternative scenarios. The alternatives presented illustrate the sensitivity of the long-term projected financial position of the Plan to changes in the future economic and demographic outlook. The scenarios in subsections B and C portray a generally younger and older population.

The scenarios reflect the possible outlooks on each of the principal assumptions, taking into account the interrelationships between these assumptions. For example, one could assume a much lower fertility rate but might also assume that immigration policies would change to partly compensate for the reduction in population growth that would otherwise occur. As another example, one may suggest longer life expectancy at age 65 combined with an increased average age at retirement. The choice of assumptions will always remain subjective to a certain degree and one could always argue that the range of possible projected outcomes presented herein is not realistic. However, we must keep in mind that these alternative scenarios are only presented to provide a reasonable range of possible future outcomes for the costs of the Plan.

Because the projected financial status of the Plan is very sensitive to the assumed demographic outlook, the alternative scenarios presented in subsections B and C are demographically based. First we look at the younger population alternative where the ratio of retirees to workers would be lower than under the best-estimate assumption. The second scenario has a ratio of retirees to workers that is higher than the best-estimate and can be referred to as the older population scenario. The economic outlook under both demographic alternatives has been adjusted to reflect the anticipated effects of a modified demographic environment on the main economic variables that affect the Plan. Results are shown in subsection D.

In addition to the younger and older population scenarios, the impact of financial markets volatility on the financial status of the Plan is examined in subsection E. Sensitivity tests on an individual assumption basis were also performed for the main assumptions and are presented in Appendix C of this report.

B. Younger Population Scenario

Under the younger population scenario, it is assumed that the total fertility rate is 1.80 per woman for Canada and 1.75 for Québec. These are 0.20 higher than the best-estimate assumption. These rates could be attained if the current increasing trend in fertility for those aged 30 and over is extrapolated further in time than has been done under the best-estimate scenario. These levels of fertility remain well under the national population replacement rate of 2.1 and correspond to the 1970s experience.

Under a scenario of a younger population, net migration to Canada is assumed to reach a level of 0.64% of the population by the year 2005. This is an 18.5% increase from the best-estimate and corresponds to the level of migration observed during the mid-1990s. Mortality is assumed to improve at half the rate assumed in the best-estimate scenario. This reflects to a certain degree the slowdown in mortality improvements observed over the last few years. This results in life expectancy at age 65 being reduced by about one year for both males and females.

The combination of these younger population assumptions results in a dependency ratio of those aged 65 and over to the working-age population (20-64) of about 0.40 (or 2.5 workers per retiree) in 2050. This is 7% lower than under the best-estimate scenario where the ratio reaches a level of 0.43 (or 2.3 workers per retiree) in 2050.

It was assumed that under a better demographic outlook the anticipated labour shortage would be less severe. As a result, it was assumed that the ultimate unemployment rate would be slightly higher than under the best-estimate, i.e. 7.0% as opposed to 6.5%, and that the labour force participation rates would be somewhat lower, especially for ages 55 and over. With a larger labour force there would be less pressure to work to a later age, and both employers and unions would more easily manage early retirement.

Furthermore, due to the reduced risk of an anticipated labour shortage, there would be less pressure on average wages as the demand for workers would be met more easily. For this reason, the assumed ultimate real wage increase was reduced from 1.2% to 1.0%. Prices are assumed to be lower under such a scenario as the average consumer demand for goods can be met with more ease through a larger labour force. The ultimate price increase assumption was set at 2.5% as opposed to 2.7%.

Disability incidence rates were reduced under this scenario as slightly better economic conditions prevail. Disability incidence rates were set at 3.00 per thousand for males and 3.25 per thousand for females.

Under this scenario, the ultimate real increase in total employment earnings is 1.7% as opposed to 1.5% under the best-estimate. The lower real-wage increases under the younger population scenario are more than offset by the higher population increases, so there is a larger real increase in total employment earnings.

Finally, capital markets are assumed to perform better under such conditions as individuals are generally better off economically and are willing to take on additional risk. This would on average yield a higher return on their investments. For this purpose, the real rate of return on assets is increased by 0.4% to 4.5%.

C. Older Population Scenario

Under the older population scenario, it is assumed that the total fertility rate is 1.40 per woman for Canada and 1.35 for Québec. These are 0.20 lower than the best-estimate assumption. These rates are lower than current observed total fertility levels and could be attained if fewer women have multiple births over their lifetime.

Under a scenario of an older population, net migration to Canada is assumed to fall to a level of 0.44% of the population by the year 2005. This is 18.5% lower than the best-estimate and corresponds to the level of migration observed during the recession of the early 1980s. Mortality is assumed to improve at a rate that is 50% higher than assumed in the best-estimate scenario. This results in life expectancy at age 65 being increased by about one year for both males and females.

The combination of these older population assumptions results in a dependency ratio of the 65 and over to the working-age population (20-64) of about 0.51 (or 1.96 workers per retiree) in 2050. This is 19% higher than under the best-estimate scenario where the dependency ratio reaches a level of 0.43 (or 2.3 workers per retiree) in 2050.

It was assumed that with a poorer demographic outlook the anticipated labour shortage would be more severe. For this purpose, it was assumed that the ultimate unemployment rate would be slightly lower than under the best-estimate, i.e. 6.0% as opposed to 6.5%, and that the labour force participation rates would be somewhat higher, especially for ages 55 and over. With a smaller labour force there would be more pressure to work to a later age and early retirement would be more difficult to manage for both employers and unions.

Furthermore, due to the increased risk of a labour shortage, there would be upward pressure on average wages as the demand for workers would be met with greater difficulty. For this reason, the assumed ultimate real wage increase was increased from 1.2% to 1.4%. Prices are assumed to be higher under such an environment as a reduced labour force cannot meet the consumer demand for goods as economically. The ultimate price increase assumption was set at 3.0% as opposed to 2.7%.

Disability incidence rates were increased under this alternative as slightly worse economic conditions prevail. Disability incidence rates were set at 3.50 per thousand for males and 3.75 per thousand for females.

Under this scenario, the ultimate real increase in total employment earnings is 1.2% as opposed to 1.5% under the best-estimate. The higher real-wage increases are more than offset by the lower population increases, so there is a smaller real increase in total employment earnings.

Finally, capital markets are assumed to perform worse under such conditions as individuals are generally worse off economically and are less willing to take on risk. This would on average yield a lower return on their investments. For this purpose, the real rate of return on assets is decreased by 0.4% to 3.7%.

D. Results

Table 17 presents a summary of the assumptions used in the sensitivity analysis. Tables 18 and 19 present the financial development under both the younger and older population scenarios, respectively. Both projections assume the currently scheduled contribution rate of 9.9%. The steady-state contribution rates are 9.3% and 10.3% for the younger and older population scenarios, respectively. Chart 7 shows the evolution of the asset/expenditure ratio under the younger, best-estimate and older population scenarios with the legislated contribution rate of 9.9%, while Chart 8 shows the asset/expenditure ratio if the resulting steady-state rates are used.

Table 17 Summary of Sensitivity Test Assumptions

Canada	Younger Population	Best-Estimate	Older Population
Total fertility rate	1.80	1.60	1.40
Net migration rate	0.64%	0.54%	0.44%
Mortality	50% of best-estimate improvement rate	1995-97 Canada Life Tables with improvements	150% of best-estimate improvement rate
CPP disability incidence rates (per 1,000 eligible)	Males 3.00 Females 3.25	Males 3.25 Females 3.50	Males 3.50 Females 3.75
Labour force participation (2030+) (15-69)	Males 77% Females 67%	Males 78% Females 69%	Males 79% Females 70%
Unemployment rate	7.0%	6.5%	6.0%
Real-wage differential	1.0%	1.2%	1.4%
Rate of increase in prices	2.5%	2.7%	3.0%
Real rate of return on investments	4.5%	4.1%	3.7%
Steady-State Rate	**9.3%**	**9.8%**	**10.3%**

Table 18 Financial Status Under Younger Population Scenario
($ billion)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*	Asset/ Expenditure Ratio
	(%)	(%)							
2004	8.25	9.9	289.4	28.7	23.9	4.8	4.7	77.1	3.09
2005	8.33	9.9	299.6	29.7	25.0	4.7	5.8	87.6	3.36
2010	8.61	9.9	369.3	36.6	31.8	4.8	9.8	151.8	4.53
2015	9.01	9.9	464.6	46.0	41.9	4.1	16.0	240.9	5.44
2020	9.60	9.9	578.2	57.2	55.5	1.7	23.8	357.7	6.09
2025	10.42	9.9	701.9	69.5	73.1	(3.6)	32.7	496.3	6.44
2050	10.65	9.9	2,020.2	200.0	215.1	(15.1)	135.7	2,063.9	9.21
2075	10.02	9.9	5,854.8	579.6	586.4	(6.8)	671.6	10,242.8	16.75

* All asset components are valued at market.

Table 19 Financial Status Under Older Population Scenario
($ billion)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*	Asset/ Expenditure Ratio
	(%)	(%)							
2004	8.27	9.9	288.8	28.6	23.9	4.7	4.3	76.7	3.07
2005	8.37	9.9	298.2	29.5	25.0	4.6	5.3	86.5	3.31
2010	8.80	9.9	363.0	35.9	32.0	4.0	8.3	143.0	4.24
2015	9.19	9.9	461.8	45.7	42.5	3.3	13.8	217.7	4.82
2020	9.68	9.9	595.7	59.0	57.6	1.3	20.2	317.1	5.17
2025	10.37	9.9	751.4	74.4	77.9	(3.6)	27.4	432.6	5.24
2050	12.03	9.9	2,255.6	223.3	271.4	(48.1)	74.0	1,156.5	4.06
2075	12.96	9.9	6,432.0	636.8	833.3	(196.5)	-	-	-

* All asset components are valued at market.

Chart 7 Asset/Expenditure Ratio Under Alternative Population Scenarios (9.9%)

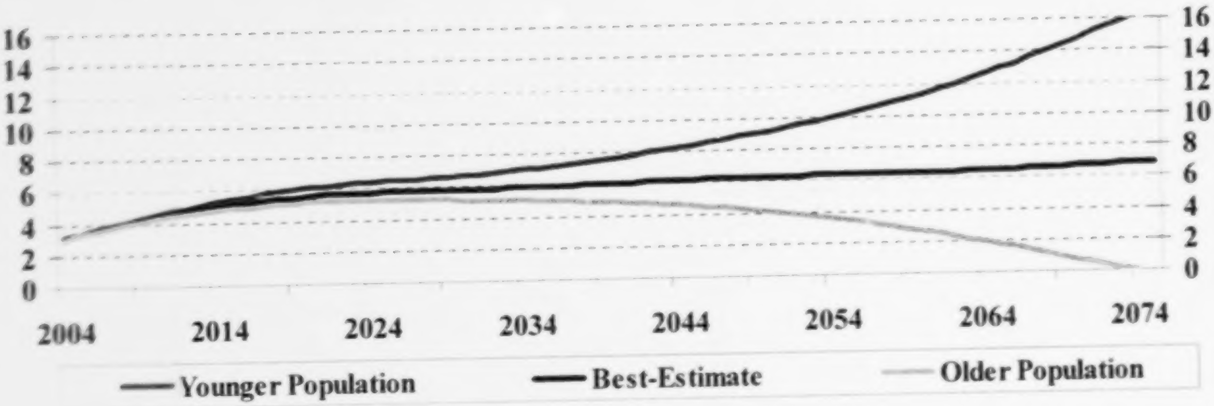
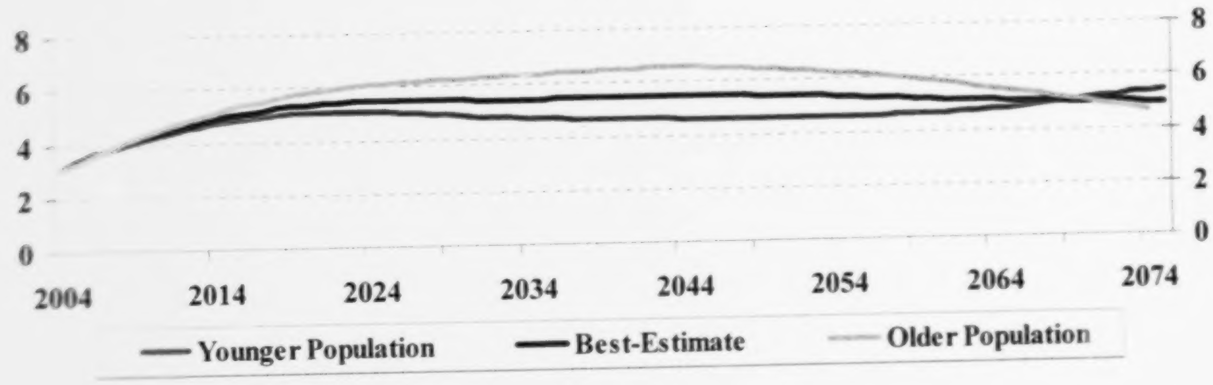


Chart 8 Asset/Expenditure Ratio Under Alternative Population Scenarios (Steady-State)



E. Financial Markets Volatility

As a result of the review of the Plan in 1996, it was determined that to ensure the sustainability of the CPP, higher rates of return would be required. Continuing to invest solely in short-term and low risk fixed income instruments was not considered to be an option, since it would ultimately require a higher contribution rate.

Hence, the CPP Investment Board was created to invest the assets of the Plan in a diversified portfolio. This includes investing in equities and other asset classes, as well as fixed income instruments with the aim of achieving higher returns. The role of the CPP Investment Board will become increasingly important as assets are expected to grow rapidly over the next 17 years with contributions to the Plan projected to exceed expenditures over this period. After 2021, investment earnings will be required to meet expenditures.

Historically, equities have shown greater volatility than fixed income instruments (bonds), where volatility is a measure of the magnitude of fluctuation in rates of returns. Investors seeking higher returns may invest in equities; however, greater risk is incurred. This describes a key risk-reward relationship, whereby investors seek a higher level of return over the long term, or an equity risk premium, in exchange for undertaking greater risk. Nevertheless, over the short term, the potential for higher returns exists along with the downside risk of lower returns due to the higher level of volatility.

Higher returns are possible by investing more in equities (thereby incurring more risk) than in relatively safer (less risky) fixed income instruments, which tend to yield lower returns. By investing in lower return and lower risk assets, investment objectives may not be achieved over the long term. If CPP assets were invested solely in long-term federal bonds starting in 2010, a much lower return would be realized. This could, in turn, result in a steady-state contribution rate higher than the currently legislated rate of 9.9%.

Table 20 shows the change in assets resulting from equity returns being different than the best-estimate assumption in each of the years 2017 and 2018. Equity rates of return of -10%, 0%, and +15% are considered to occur in years 2017 and 2018. Cumulative year-end assets and the asset/expenditure ratio are also shown using the 9.9% contribution rate. In all cases, it is assumed that the returns revert back to their best-estimate values from 2019 onward. The best-estimate year-end assets and asset/expenditure ratio are also shown in the table for comparison.

As shown in Table 20, cumulative assets would decrease by $49 billion or 17% by the end of 2018 as a result of a -10% equity return in 2017 and 2018 compared to the best-estimate assumption. If an equity return of 0% were experienced, then the assets would decrease by $22 billion. The effect is reversed in the event of a strong positive return of 15% with the assets increasing by $22 billion by the end of 2018.

Table 20 Financial Status Under Various Equity Returns in 2017 and 2018
(9.9% contribution rate)

Year	Best-Estimate Equity Returns		Equity Returns in 2017 and 2018								
			-10%			0%			+15%		
	Assets at 31 Dec.	A/E Ratio	Assets at 31 Dec.	Change in Assets	A/E Ratio	Assets at 31 Dec.	Change in Assets	A/E Ratio	Assets at 31 Dec.	Change in Assets	A/E Ratio
	($ billion)		($ billion)	($ billion)		($ billion)	($ billion)		($ billion)	($ billion)	
2010	147	4.4	147	–	4.4	147	–	4.4	147	–	4.4
2016	246	5.2	246	–	5.2	246	–	5.2	246	–	5.2
2017	266	5.3	242	(24)	4.8	256	(10)	5.1	276	10	5.5
2018	287	5.4	238	(49)	4.5	266	(22)	5.0	310	22	5.8
2019	309	5.5	257	(52)	4.6	286	(23)	5.1	333	24	5.9
2020	332	5.6	276	(56)	4.6	307	(25)	5.2	358	26	6.0
2025	455	5.8	376	(78)	4.8	420	(34)	5.3	490	36	6.2
2030	591	5.8	483	(109)	4.7	543	(48)	5.3	641	50	6.3
2050	1,554	6.3	1,147	(407)	4.6	1,375	(179)	5.6	1,739	185	7.0

As the return on the assets increases, the asset/expenditure ratio also increases. Higher returns provide room for the assets to absorb some of the impact of future adverse experience. Higher returns would also cause the steady-state contribution rate to decrease. For instance, in the case of an equity return of +15% in years 2017 and 2018, the steady-state contribution rate would decrease from 9.8% to 9.7%. Conversely, negative returns remove room to offset adverse experience. In the case of an equity return of -10% in years 2017 and 2018, the steady-state contribution rate would increase from 9.8% to 10.0%.

Contributions are projected to exceed expenditures until 2021 after which time investment earnings will be required to pay for expenditures. Thus, assets are expected to grow until 2021 even though negative returns occur in 2017 and 2018, while after this period negative returns cause the assets to decrease from one year to the next. However, if the Plan were solely invested in less risky fixed income instruments, this would result in the steady-state contribution rate increasing significantly as investment earnings would not be sufficient to meet expenditures in the long term. It is for this reason that the CPP Investment Board was created to invest the assets in a diversified portfolio, including equities as well as other classes, necessarily incurring risk, with the purpose of earning higher rates of return to help ensure the long-term financial sustainability of the Plan.

VI. Conclusion

The results contained in this report confirm that the legislated contribution rate of 9.9% in 2004 and thereafter is sufficient to pay for future expenditures and to accumulate assets of $147 billion (4.4 times the annual expenditures) in 2010. In 2050, the assets are projected to be $1,554 billion or 6.3 times the annual expenditures.

The steady-state contribution rate determined under this report is 9.8%. Better than anticipated economic experience, especially regarding labour force participation and employment data, over the period 2001 to 2003, combined with the amendments since the last report, have put downward pressure on the steady-state contribution rate. On the other hand, a more pessimistic demographic outlook, due to the continuing downward trend in fertility rates and increases in longevity, combined with lower expectations with respect to inflation and rates of return on investments, have put upward pressure on the steady-state contribution rate. These factors tend to counterbalance each other, leaving the steady-state contribution rate unchanged at 9.8%.

To measure the sensitivity of the long-term projected financial position of the Plan to changes in the future economic and demographic outlook, two demographically based scenarios that portray a generally younger and older population were developed. The younger and older population scenarios produced steady-state contribution rates of 9.3% and 10.3%, respectively.

Under the legislated 9.9% contribution rate, the assets are projected to grow rapidly over the next 17 years as contributions are expected to exceed expenditures over that period. The asset/expenditure ratio will grow from 3.1 in 2004 to 5.6 in 2021, and remain somewhat stable as the baby boom generation retires between 2015 and 2035. The retirement of the baby boomers will create upward pressure on the Plan outflows as part of the investment income will be required to pay for benefits since contributions will not be sufficient to cover the benefits. However, assets will continue to grow until the end of the projection period, but at a slower pace and the asset/expenditure ratio is expected to reach a level of 6.3 by 2050.

These are indicators that the Plan is sustainable over the long term, as it is projected that there will be more inflows than outflows to the Plan over the entire projection period. The pool of assets generated over the projection period provides the Plan with the capacity, through investment earnings, to absorb some of the possible unforeseen economic or demographic fluctuations, which otherwise would have to be reflected in the legislated contribution rate. Thus, despite the substantial increase in benefits paid as a result of an aging population, the Plan is expected to be able to meet its obligations throughout the projection period. There exist other measures of the long-term sustainability of the Plan and these are presented in Appendix D of this report.

The projected financial status of the Canada Pension Plan presented in this report is based on the assumed demographic and economic outlook over the long term. Therefore, it remains important to review the Plan's long-term financial status on a regular basis by producing periodic actuarial reports. For this purpose, as required by the *Canada Pension Plan*, the next such review will be as at 31 December 2006.

VII. Actuarial Opinion

In our opinion, considering that this Twenty-First Actuarial Report was prepared pursuant to the *Canada Pension Plan*:

- the methodology employed is appropriate and consistent with sound actuarial principles;
- the data on which this report is based are sufficient and reliable; and
- the assumptions used are, in aggregate, reasonable and appropriate.

This report has been prepared, and our opinions given, in accordance with accepted actuarial practice.

Jean-Claude Ménard

Jean-Claude Ménard, F.S.A., F.C.I.A.
Chief Actuary

Michel Montambeault

Michel Montambeault, F.S.A., F.C.I.A.
Senior Actuary

Michel Millette

Michel Millette, F.S.A., F.C.I.A.
Senior Actuary

Ottawa, Canada
18 November 2004

Appendix A – Summary of Plan Provisions

I. Introduction

The Canada Pension Plan (CPP) came into force on 1 January 1966. Since that time, it has been amended several times, the most recent occasions as a result of Bill C-3 (gradual transfer of all assets to the CPP Investment Board) which received Royal Assent on 3 April 2003 and Part 4 of Bill C-30 (clarification of rules for employer contributions and disability benefit reinstatements) which received Royal Assent on 14 May 2004. The details of the cost impact of each of those Bills can be found in the 19th and 20th Actuarial Reports supplementing the 18th Actuarial Report on the Canada Pension Plan as at 31 December 2000.

II. Participation

The CPP includes virtually all members of the labour force in Canada, including both employees and self-employed persons between the ages of 18 and 70 with employment earnings, other than those covered by the Québec Pension Plan (QPP). The main exceptions are persons with annual earnings lower than $3,500 (the Year's Basic Exemption, defined below), members of certain religious groups and other persons who qualify under excepted employment. It should be noted that the CPP covers all members of the Canadian Forces and the Royal Canadian Mounted Police, including those residing in the province of Québec. The persons to whom a CPP retirement or disability pension is payable are not required to contribute.

III. Definitions

A. Year's Maximum Pensionable Earnings (YMPE)

The YMPE for a calendar year is the limit to which employment earnings are subject to contributions for purposes of the Plan. The YMPE increases each year to the extent warranted by the percentage increase, as at 30 June of the preceding year, in the 12-month average of the Industrial Aggregate (the measure of the Average Weekly Earnings by Statistics Canada). If the amount so calculated is not a multiple of $100, the next lower multiple of $100 is used (although the exact amount forms the basis for the following year's calculation). Under no circumstances is the YMPE allowed to decrease from one year to the next. The YMPE is set at $40,500 in 2004.

B. Year's Basic Exemption (YBE)

The YBE for a calendar year is the minimum employment earnings necessary to participate in the Plan. As well, contributions are waived on earnings up to the YBE. Prior to 1998, the YBE was calculated as 10% of the YMPE and rounded, if necessary, to the next lower multiple of $100. For each year after 1997 the YBE is $3,500.

C. Contributory Period

The contributory period is the number of months from attainment of age 18 or from 1 January 1966, if later, to the earliest of the month in which the contributor dies, the month before the one in which the retirement pension commences and the month before the one in which the contributor reaches 70 years of age, less the number of months during which the contributor received a CPP or QPP disability benefit (including the three-month waiting period), or during which the contributor had at least one eligible child under seven years of age and had earnings for that year lower than the YBE.

D. Pension Index

The Pension Index for a given calendar year is equal to the Consumer Price Index averaged over the 12-month period ending with October of the preceding year; however, the Pension Index of a given year may not be less than the previous year's Pension Index.

IV. Contribution Rates

Contributions are required during the contributory period in respect of the contributory earnings of each contributor. From 1966 to 1986, the annual rate of contribution applicable to contributory earnings was 1.8% for employees (and a like amount for their employers) and 3.6% in respect of self-employed earnings. This combined employer-employee contribution rate of 3.6% was subject to an annual increase of 0.2% for 1987 to 1996, attaining 5.6% in the last year of this period.

Combined contribution rates for 1997 to 2003 increased in steps to reach a combined employer-employee contribution rate of 9.9% by 2003, with no subsequent increases scheduled.

Schedule of Contribution Rates

Year	Contribution Rate (%)
1997	6.00
1998	6.40
1999	7.00
2000	7.80
2001	8.60
2002	9.40
2003+	9.90

The legislation gives the federal and provincial ministers of finance the authority to make changes in contribution rates through regulation, in connection with a triennial review. However, year-over-year contribution rate increases cannot exceed 0.2%; beyond that, legislation is required.

If a triennial actuarial report projects a steady-state contribution rate in excess of the scheduled rate and the Ministers cannot agree upon appropriate changes, the regulation concerning the calculation of default contribution rates approved on 21 May 2001 would apply. The contribution rate would then be increased in stages and a temporary freeze on inflation adjustments of benefits in payment would apply.

V. Retirement Pension

A. Eligibility Requirements

A person aged 60 or over becomes eligible for a retirement pension upon application, provided contributions have been made during at least one calendar year. For a retirement pension to become payable before age 65, an applicant must have wholly or substantially ceased to be engaged in paid employment or self-employment. A person may not contribute to the CPP after a retirement pension becomes payable or, in any event, after age 70.

B. Amount of Pension

The initial amount of monthly retirement pension payable to a contributor is based on his or her whole history of pensionable earnings during the contributory period. The retirement pension is equal to 25% of the average of the YMPE for the year of his or her retirement and the four previous years, referred to as the Maximum Pensionable Earnings Average (MPEA), adjusted to take into account the contributor's pensionable earnings. For this purpose, the contributor's pensionable earnings for any given month are indexed by the ratio that the MPEA for the year of retirement bears to the YMPE for the year to which the given month belongs.

Some periods with low pensionable earnings may be excluded from the calculation of benefits, by reason of pensions commencing after age 65 and the disability, the child-rearing dropout for a child less than seven years of age and the 15% dropout provisions.

The maximum monthly retirement pension in 2004 is $814.17.

C. Adjustment for Early or Postponed Retirement

The retirement pension is subject to an actuarial adjustment that depends on the contributor's age at commencement of the retirement pension. The retirement pension is permanently adjusted downwards or upwards by 0.5% for each month between age 65 and the age when the pension commences or, if earlier, age 70.

VI. Disability Benefit

A. Eligibility Requirements

A person is considered disabled if he or she is determined to be suffering from a severe and prolonged mental or physical disability. A disability is considered severe if by reason of it the person is regularly incapable of pursuing any substantially gainful occupation; a disability is considered prolonged if it is likely to be long-continuing and of indefinite duration or likely to result in death.

A person who becomes disabled while under age 65 and not receiving a CPP retirement pension is eligible for a disability benefit provided that contributions have been made, at the time of disablement, for at least four of the last six calendar years, counting only years included wholly or partly in the contributory period. Contributions must be on earnings that are not less than 10% of the YMPE rounded, if necessary, to the next lower multiple of $100.

B. Amount of Pension

The amount of monthly benefit payable is the sum of a flat-rate portion ($382.17 in 2004) depending only on the year in which the benefit is payable and an earnings-related portion equal, when it commences, to 75% of the retirement pension that would be payable at the onset of disability if the contributory period ended on that date and no actuarial adjustment applied.

The automatic conversion at age 65 of a disability benefit into a retirement pension is based on the pensionable earnings at the time of disablement and price indexed to age 65. In other words, the indexing from disablement to age 65, which determines the initial rate of the retirement pension, is in line with increases in prices rather than wages. The maximum monthly disability benefit in 2004 is $992.80.

VII. Survivor Benefit

A. Eligibility Requirements

The legal spouse, the separated legal spouse not cohabiting with a common-law partner or a common-law partner of the deceased contributor, is eligible for a survivor benefit if the following conditions are met as at the date of the contributor's death.

- The deceased contributor must have made contributions during the lesser of ten calendar years, or one-third of the number of years included wholly or partly in his or her contributory period, but not for less than three years.

- If the surviving spouse is the separated legal spouse of the deceased contributor, there must be no cohabiting common-law partner at the time of death. If the surviving spouse is the common-law partner of the deceased contributor, they must have cohabited for not less than one year immediately before the death of the contributor. If the common-law partner is of the same-sex as the deceased contributor, the death must have occurred on or after 1 January 1998.

- The surviving spouse or common-law partner must have dependent children, be disabled or be at least 35 years of age. A surviving spouse or common-law partner with dependent children means a surviving spouse who wholly or substantially maintains a child of the deceased contributor where the child is under age 18, or aged 18 or over but under age 25 and attending school full-time, or aged 18 or over and disabled, having been disabled without interruption since attaining age 18 or the time of the contributor's death, whichever occurred later.

B. Amount of Pension

The amount of the monthly survivor benefit depends on the age of the survivor at the date of the contributor's death, the survivor's disability status and the presence of dependent children. If a surviving spouse or common-law partner is receiving a retirement pension or a disability benefit, the monthly amount of the surviving spouse's benefit may be reduced. The following five cases are relevant:

1. New Survivor Age 45 to 65

The amount of monthly benefit payable until the surviving spouse or common-law partner attains age 65 is composed of two portions: a flat-rate benefit depending only on the year in which the survivor benefit is payable ($149.11 in 2004), and an earnings-related benefit depending initially only on the contributor's record of pensionable earnings as at the date of death. The initial earnings-related portion is equal to 37.5% of the retirement pension that would have been payable to the deceased contributor if the contributory period ended at the time of death with no actuarial adjustment.

2. New Survivor Under Age 45

An eligible spouse or common-law partner, without dependent child(ren) and not disabled, who becomes widowed before age 35 is not entitled to a survivor's benefit but may be entitled at a later date if she or he becomes disabled (see 4) or attains age 65 (see 5). If such survivor is between 35 and 45 years of age, she or he is entitled to an amount of benefit calculated as described in 1 above but reduced (until the earlier of disablement or attainment of age 65) by 1/120 of such amount for each month that the new survivor's age is less than 45.

3. New Survivor Under Age 45 with Dependent Child(ren)

An eligible spouse or common-law partner who becomes widowed while less than age 45 and with dependent child(ren) is entitled to a survivor benefit calculated as in 1 above. Under certain circumstances, the survivor benefit is reduced or even discontinued when the survivor no longer has his/her last dependent child(ren). If the survivor is then under age 45 and not disabled, she or he is considered to be a new survivor entitled only to the benefit in accordance with 2 above.

4. Disabled Survivor Under Age 65

An eligible surviving spouse or common-law partner under age 65 is entitled to a survivor benefit calculated as in 1 above whenever she or he is disabled. If the disabled surviving spouse or common-law partner recovers from disability before age 45, the survivor benefit is discontinued or reduced to what it would be for a new survivor in accordance with 2 above.

5. Survivor Age 65 or Over

At age 65, or upon becoming widowed at a later age, an eligible surviving spouse or common-law partner is entitled to a monthly benefit equal to 60% of the retirement pension of the deceased contributor with no actuarial adjustment.

VIII. Death Benefit

A lump sum benefit is payable to the estate of a deceased contributor if the eligibility rules for survivor benefits are met. The amount of the death benefit is equal to six times the monthly amount of retirement pension accrued or payable in the year of death, adjusted to exclude any actuarial adjustments, subject to a maximum of $2,500.

IX. Child Benefits

Each child under age 18 and each full-time student aged 18 to 25 who is dependent on a contributor eligible for a CPP disability benefit or was dependent on a deceased contributor satisfying the contribution requirement for a survivor benefit is entitled to a flat-rate monthly benefit ($192.68 in 2004). Furthermore, where applicable, a child may receive simultaneously more than one child benefit.

X. Inflation Adjustments

All monthly benefits payable are increased in accordance with inflation each year. Benefits are multiplied on 1 January of each calendar year by the ratio of the Pension Index applicable for that calendar year to the Pension Index for the preceding year.

XI. Credit-Splitting

Pensionable earnings may be split between divorced or separated couples (legal or common-law partners) for each year the couple lived together. Pensionable earnings are used to establish eligibility for CPP benefits and to calculate the amount of benefits. Contributors may obtain a credit split even if they have remarried. However, pensionable earnings cannot be split for any month in which the earnings allocated to each spouse would be less than 1/12 of the YBE.

XII. Pension Sharing

Couples (legal or common-law partners) in an ongoing relationship may voluntarily (at the request of one of them) share their CPP retirement pensions in proportion to the number of years during which they cohabited. This applies provided both spouses have reached the minimum age requirement to receive a retirement pension. Sharing is possible even if only one of the spouses has participated in the Plan. Pension sharing ceases upon separation, divorce, or death.

Appendix B – Assumptions and Methods

I. Introduction

This section describes the assumptions and methods that underlie the financial projections in Section IV of the report.

The future cash flows are over a long period of time, i.e. 75 years, and depend on assumptions such as fertility, mortality, migration, labour force, job creation, unemployment rates, inflation, employment earnings and investment returns. These assumptions form the basis for the projections of future income and expenditures of the Plan. Over the years, the cumulative difference between the revenues from contributions and investment earnings and the expenditures of the Plan generates the accumulated assets. The ratio of the end-of-year assets to the following year's expenditures is then calculated and used to determine the steady-state contribution rate, which is the lowest contribution rate that in the long term would generally stabilize the ratio of assets to expenditures.

Although the economic and demographic assumptions have been developed using the best available information, the resulting estimates should be interpreted with caution. These estimates are not intended to be predictions but rather projections of the future financial status of the CPP.

II. Demographic Projections

Both the historical and projected populations of Canada less Québec are required for the calculation of future CPP contributions and benefits of the relevant cohorts of contributors and beneficiaries.

The populations of Canada and Québec as at 1 July 2003 are used as a starting point. The populations are then projected by age and sex from one year to the next by adding births and net migrants and subtracting deaths. Applying the fertility, mortality and migration assumptions to the starting population develops the annual numbers of births, deaths and net migrants. The population of Canada less Québec is then obtained by subtracting the projected population of Québec from the projected population of Canada.

The population covered by the CPP pertains to Canada less Québec, but includes all members of the Canadian Forces (CF) and the Royal Canadian Mounted Police (RCMP). Consequently, the approach used above to determine the CPP population does not make an explicit allowance for the members of the CF or RCMP residing in Québec or outside Canada. However, provision for this group was made implicitly through the development of the number of people with earnings and the proportion of contributors as described in section III of this Appendix.

A. Initial Population as at 1 July 2003

The starting point for the demographic projections is the most recent Statistics Canada population estimates as at 1 July 2003 for Canada and Québec, by age and sex. The estimates are based on the 2001 census and are adjusted for the census undercount.

B. Fertility Rates

The fertility rate for a given age and year is the average number of live births per female of that age during that year. The total fertility rate for a year is the average number of children that would be born to a woman in her lifetime if she experienced the age-specific fertility rates observed in, or assumed for, that year.

Total fertility rates have declined significantly over the last 50 years, from a high of about 4.0 in the late 1950s for both Canada and Québec to recent lows of about 1.5 in the late 1990s. The total fertility rate increased briefly over the early 1990s to reach levels of about 1.70 and 1.65 for Canada and Québec, respectively. Although, the total fertility rate averaged about 1.62 for Canada over the last two decades, it currently stands at 1.51 for Canada in 2001 and 1.45 for Québec in 2002. These variations in the total fertility rate have resulted from changes in many factors, including social attitudes and economic conditions.

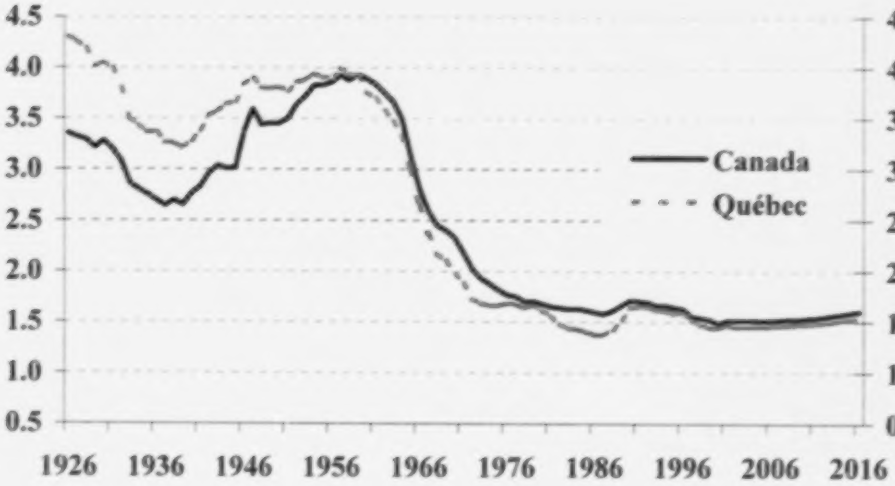
In this report, it was assumed that the total fertility rate from 2016 onward would be 1.60 for Canada and 1.55 for Québec. These assumed ultimate rates reflect historical trends in fertility by age group over the last 15 years. They are slightly higher than the most recently observed rates. A small increase in total fertility rates is expected over the medium-term horizon because of continued trends in women having their first child at a later age due to increased labour force participation, later marriages and longer stays in the education system. Economic conditions are also assumed to improve over the medium term and could help families plan for additional children.

Finally, in accordance with the experience over the last 25 years, the assumed ratio of male to female newborns was maintained at 1.056. Table 21 and Chart 9 below show the historical and projected age-specific and total fertility rates.

Table 21 Total Fertility Rates
(Canada)

Year	Annual Fertility Rates by Age Group (per 1,000 women) 15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total Fertility Rates Per Woman
2004	16.2	53.3	93.2	94.4	38.2	6.6	0.3	1.51
2005	16.2	52.3	91.7	95.8	39.1	6.8	0.3	1.51
2006	16.2	51.4	90.1	97.3	40.0	6.9	0.3	1.51
2007	16.2	51.4	88.5	98.8	40.9	7.1	0.3	1.52
2008	16.2	51.4	87.0	100.3	41.8	7.3	0.3	1.52
2009	16.2	51.4	85.4	101.8	42.6	7.4	0.4	1.53
2010	16.2	51.4	83.9	103.3	43.5	7.6	0.4	1.53
2011	16.2	51.4	82.3	104.8	44.4	7.8	0.4	1.54
2012	16.2	51.4	82.3	106.3	45.3	7.9	0.4	1.55
2013	16.2	51.4	82.3	107.7	46.2	8.1	0.4	1.56
2014	16.2	51.4	82.3	109.2	47.1	8.3	0.4	1.57
2015	16.2	51.4	82.3	110.7	48.0	8.4	0.4	1.59
2016+	16.2	51.4	82.3	112.2	48.9	8.6	0.4	1.60

Chart 9 Historical and Assumed Total Fertility Rates



C. Mortality

The starting point for mortality rate projections for this report is the mortality rates from the Statistics Canada publication "Life Tables, Canada, provinces and territories, 1995-1997". According to these tables, life expectancies at birth for males and females in Canada were 75.4 and 81.2 years, respectively. The 2000 to 2002 Life Tables were not yet available for this report.

To reflect anticipated sustained improvements in life expectancy, the 1995 to 1997 Canada and Québec mortality rates were projected to 2001 using the actual improvements in mortality experienced between 1996 and 2001. This approach produced life expectancies at birth of 77.1 years for males and 82.2 for females. The life expectancies at age 65 are 17.1 years and 20.6 years for males and females, respectively. This compares well with figures published by Statistics Canada for 2001. Mortality rates thus obtained for 2001 were then projected to the end of the projection period using the following annual rates of mortality improvement.

For 2002 to 2006, the annual rates of mortality improvement, varying by age and sex, were set equal to the average annual improvement rates experienced in Canada over the period 1991 to 2001. Improvement rates for years 2007 to 2025 were obtained by linear interpolation between:

- the improvement rates of year 2006, and
- the fixed improvement rates described below in respect of the period 2026 and thereafter.

For 2026 and subsequent years, the assumed annual rates of mortality improvement vary by age and sex only and not by calendar year. These ultimate rates were derived from an analysis of the Canadian and U.S. experience over the last century and are generally consistent with the Alternative II assumption used in the 2003 Old-Age and Survivors Insurance and Disability Insurance Trustees Report. Table 22 shows the assumed initial (2002 to 2006) and ultimate (2026+) annual mortality improvement rates.

Table 22 Annual Mortality Improvement Rates for Canada

	Males		Females	
Age	2002-2006	2026+	2002-2006	2026+
	%	%	%	%
0	2.25	1.35	2.50	1.25
1-14	3.89	0.95	3.36	0.85
15-44	3.13	0.80	1.51	0.70
45-64	2.50	0.65	1.64	0.55
65-84	1.80	0.50	1.06	0.50
85-99	0.11	0.40	0.03	0.40

Table 23 Mortality Rates for Canada

(annual deaths per 1,000 people)

	Males				Females			
Age	**2004**	**2025**	**2050**	**2075**	**2004**	**2025**	**2050**	**2075**
0	4.97	3.36	2.40	1.71	4.27	2.83	2.07	1.51
10	0.09	0.05	0.04	0.03	0.09	0.05	0.04	0.04
20	0.76	0.51	0.41	0.34	0.28	0.22	0.19	0.16
30	0.86	0.52	0.42	0.35	0.37	0.28	0.24	0.20
40	1.48	1.01	0.83	0.68	0.87	0.73	0.61	0.52
50	3.27	2.35	2.00	1.70	2.14	1.69	1.47	1.28
60	8.73	5.96	5.06	4.30	5.47	4.24	3.69	3.22
65	14.82	10.38	9.02	7.84	8.85	7.12	6.25	5.49
70	24.35	17.98	15.87	14.00	14.26	11.98	10.57	9.32
75	39.22	30.18	26.63	23.49	23.63	19.73	17.40	15.35
80	64.32	52.77	46.55	41.07	41.25	35.24	31.09	27.43
85	104.55	94.10	84.28	75.48	73.52	68.11	61.00	54.63

The projected mortality rates in Table 23 indicate a continuous decrease of mortality rates over the long term. For example, the mortality rate at age 65 for males is expected to be reduced from 14.8 per thousand in 2004 to 7.8 per thousand by 2075. The gap in mortality rates between males and females is also expected to decrease over the projection period.

For 2004 to 2075, Canadian life expectancy at birth is projected to grow from 77.8 to 83.4 years for males and from 82.5 to 86.5 years for females. A narrowing of the gap between male and female life expectancies has been observed over the last 20 to 25 years in Canada. The yearly increase in life expectancies in the early years of the projection reflects the significant increase observed over the last 25 years. Thereafter, there is a projected slowdown in the increase in life expectancies consistent with the low rate of improvement in mortality assumed for years 2025 and thereafter.

Table 24 shows the resulting Canadian life expectancies at various ages for specified calendar years, assuming that the mortality rates of each such year will remain unchanged thereafter (without future improvements). Table 25 is similar to Table 24, the only difference being that it takes into account the assumed mortality improvement after the specified calendar year (with future improvements). Given the continuing trend to greater longevity, Table 25 is considered to be more realistic than Table 24.

Table 24 Life Expectancies for Canada, without improvements after the year shown*

	Males				Females			
Age	**2004**	**2025**	**2050**	**2075**	**2004**	**2025**	**2050**	**2075**
0	77.8	80.7	82.0	83.4	82.5	84.1	85.3	86.5
10	68.3	71.0	72.3	73.6	73.0	74.4	75.6	76.7
20	58.5	61.1	62.4	63.7	63.1	64.5	65.6	66.7
30	48.9	51.4	52.7	53.9	53.3	54.7	55.8	56.8
40	39.4	41.7	42.9	44.1	43.5	44.9	45.9	47.0
50	30.1	32.3	33.4	34.5	34.0	35.3	36.3	37.3
60	21.4	23.3	24.3	25.3	25.0	26.1	27.1	28.0
65	17.5	19.1	20.0	20.9	20.8	21.7	22.6	23.5
70	13.9	15.2	16.0	16.8	16.8	17.6	18.4	19.2
75	10.8	11.7	12.4	13.1	13.1	13.8	14.5	15.2
80	8.0	8.6	9.2	9.8	9.8	10.3	10.9	11.5
85	5.9	6.1	6.6	7.1	7.1	7.3	7.8	8.3

* These are calendar year life expectancies based on the mortality rates of the given attained year.

Table 25 Life Expectancies for Canada, with improvements**

	Males				Females			
Age	**2004**	**2025**	**2050**	**2075**	**2004**	**2025**	**2050**	**2075**
0	82.9	84.2	85.5	86.8	86.3	87.4	88.6	89.7
10	72.9	74.0	75.3	76.5	76.3	77.3	78.4	79.5
20	62.5	63.7	64.9	66.2	66.0	66.9	68.1	69.1
30	52.3	53.4	54.7	55.9	55.7	56.6	57.7	58.8
40	42.1	43.3	44.5	45.6	45.4	46.4	47.5	48.6
50	32.2	33.4	34.5	35.6	35.4	36.4	37.5	38.5
60	22.7	24.0	25.0	26.0	25.9	26.8	27.8	28.8
65	18.4	19.6	20.5	21.4	21.4	22.3	23.2	24.1
70	14.5	15.5	16.4	17.2	17.2	18.0	18.8	19.7
75	11.0	11.9	12.7	13.4	13.3	14.0	14.8	15.5
80	8.1	8.8	9.4	10.0	9.9	10.4	11.1	11.7
85	5.9	6.2	6.7	7.2	7.1	7.4	7.9	8.4

** These are cohort life expectancies that take into account future improvements in mortality and therefore differ from calendar year life expectancies, which are based on the mortality rates of the given attained year.

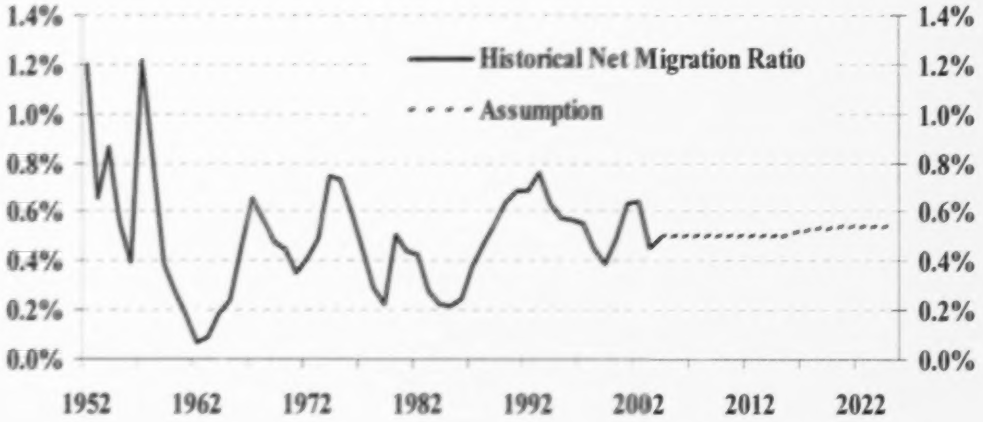
D. Migration

Immigration and emigration are generally recognized to be volatile parameters of future population growth, since they are subject to a variety of demographic, economic, social and political factors. During the period from 1972 to 2003, annual immigration to Canada varied from 84,000 to 267,000, annual emigration from Canada is estimated to have fluctuated between 40,000 and 83,000, and the annual numbers of returning Canadians have fluctuated between 14,000 and 39,000. Chart 10 below shows the net migration experience of the last half-century.

For 2004 to 2015, the net migration rate is assumed at a level of 0.50% of the population, which is the average experienced over the last 30 years. For 2015 to 2020, the ratio is gradually increased from 0.50% to 0.54% to take into account the expected labour shortage and then remains at that level thereafter. The ultimate level of 0.54% corresponds to the average over the last 15 to 20 years.

For the purpose of projecting the population of Québec, historical percentages of the Canadian migration components were attributed to Québec. In addition, based on historical data, it was assumed that Québec would experience net interprovincial emigration of 1,700 in 2003, increasing to 5,000 for 2015 and thereafter. These assumptions result in an average ultimate net migration rate of approximately 0.4% for Québec. The distributions of immigrants, emigrants and returning Canadians by age and sex used for the demographic projections were taken from Statistics Canada data averaged over the period 1999 to 2003.

Chart 10 Net Migration as % of Population
(Canada)



E. Projected Population and its Characteristics

The population of Canada as at 1 July 2003 is 31.6 million while the population of Canada less Québec is 24.1 million. Tables 26 and 27 present the projected population of Canada and Canada less Québec as at 1 July for selected years. Chart 11 shows the evolution of the total population for Canada less Québec and of those aged 20 to 64 from 1975 up to 2075. Table 28 shows the variations in the relative size of various age groups throughout the projection period. The proportion of people aged 65 and over is expected to almost double from 12.8% to 25.1% over the projection period. The number of people aged 65 and over as a proportion of people aged 20 to 64 more than doubles over the same period, from 20.6% to 45.7%. This proportion significantly affects the ratio of benefits to contributions under the CPP.

Table 29 shows the components of population growth, namely the projected number of births plus net migrants less the expected deaths for each year to 2075. Chart 12 presents these figures graphically until 2050. Over the next 20 years, the population of Canada less Québec is projected to grow at about 0.9% per year. The annual growth slows to about 0.6% between 2020 and 2040 and to 0.4% thereafter. The population of Canada less Québec is expected to reach 36.2 million by 2075.

Table 26 Population of Canada by Age
(thousands)

Year	0-17	18-69	70+	0-19	20-64	65+	Total
2004	6,982	21,947	2,968	7,844	19,914	4,138	31,896
2005	6,941	22,196	3,024	7,791	20,152	4,219	32,162
2006	6,907	22,437	3,082	7,743	20,372	4,311	32,426
2007	6,863	22,692	3,134	7,707	20,572	4,410	32,689
2008	6,808	22,955	3,190	7,679	20,749	4,525	32,954
2009	6,756	23,211	3,250	7,643	20,931	4,645	33,218
2010	6,712	23,458	3,313	7,595	21,120	4,767	33,482
2015	6,644	24,418	3,757	7,475	21,698	5,647	34,819
2020	6,857	24,831	4,514	7,619	21,928	6,655	36,202
2025	7,100	25,015	5,380	7,878	21,813	7,805	37,495
2030	7,239	25,030	6,339	8,056	21,659	8,894	38,608
2040	7,209	25,480	7,528	8,084	22,367	9,766	40,217
2050	7,372	26,204	7,791	8,229	22,824	10,314	41,367
2075	7,880	27,663	8,731	8,811	24,242	11,220	44,274

Table 27 Population of Canada less Québec by Age
(thousands)

Year	0-17	18-69	70+	0-19	20-64	65+	Total
2004	5,442	16,684	2,241	6,120	15,131	3,116	24,366
2005	5,410	16,897	2,282	6,079	15,337	3,174	24,590
2006	5,384	17,104	2,325	6,042	15,530	3,240	24,813
2007	5,353	17,320	2,364	6,015	15,711	3,311	25,037
2008	5,316	17,540	2,406	5,994	15,873	3,394	25,261
2009	5,284	17,754	2,449	5,970	16,038	3,479	25,487
2010	5,258	17,962	2,494	5,939	16,210	3,566	25,714
2015	5,237	18,831	2,810	5,889	16,760	4,230	26,879
2020	5,424	19,294	3,385	6,028	17,071	5,004	28,104
2025	5,645	19,575	4,053	6,261	17,115	5,897	29,273
2030	5,789	19,725	4,801	6,439	17,103	6,774	30,315
2040	5,822	20,297	5,818	6,526	17,822	7,590	31,937
2050	5,995	21,087	6,108	6,692	18,381	8,117	33,190
2075	6,511	22,657	7,060	7,279	19,863	9,085	36,228

Chart 11 Population of Canada less Québec
(millions)

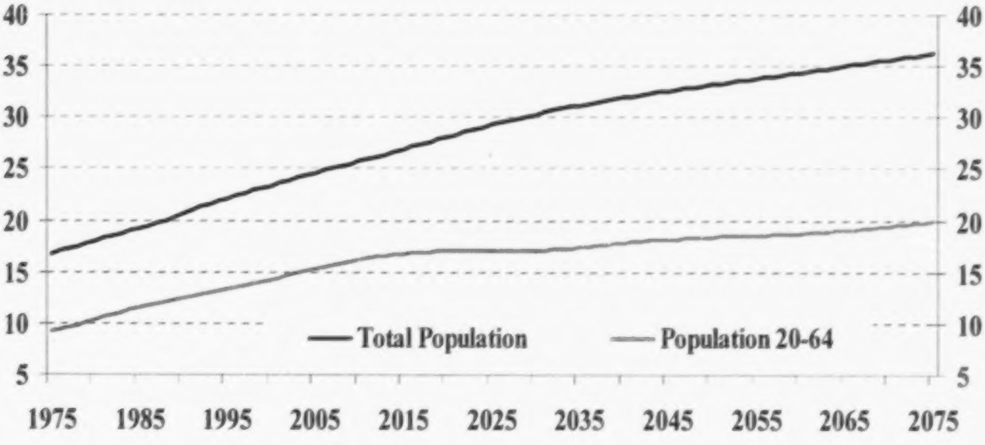


Table 28 Analysis of Population of Canada less Québec

	% of Total Population			% of Total Population			Age 65 + as % of Age 20-64
Year	Ages 0-17	Ages 18-69	Ages 70+	Ages 0-19	Ages 20-64	Ages 65+	
2004	22.3	68.5	9.2	25.1	62.1	12.8	20.6
2005	22.0	68.7	9.3	24.7	62.4	12.9	20.7
2006	21.7	68.9	9.4	24.4	62.6	13.1	20.9
2007	21.4	69.2	9.4	24.0	62.8	13.2	21.1
2008	21.0	69.4	9.5	23.7	62.8	13.4	21.4
2009	20.7	69.7	9.6	23.4	62.9	13.7	21.7
2010	20.5	69.9	9.7	23.1	63.0	13.9	22.0
2015	19.5	70.1	10.5	21.9	62.4	15.7	25.2
2020	19.3	68.7	12.0	21.5	60.7	17.8	29.3
2025	19.3	66.9	13.8	21.4	58.5	20.1	34.5
2030	19.1	65.1	15.8	21.2	56.4	22.3	39.6
2040	18.2	63.6	18.2	20.4	55.8	23.8	42.6
2050	18.1	63.5	18.4	20.2	55.4	24.5	44.2
2075	18.0	62.5	19.5	20.1	54.8	25.1	45.7

Chart 12 Components of Population Growth for Canada less Québec

(thousands)

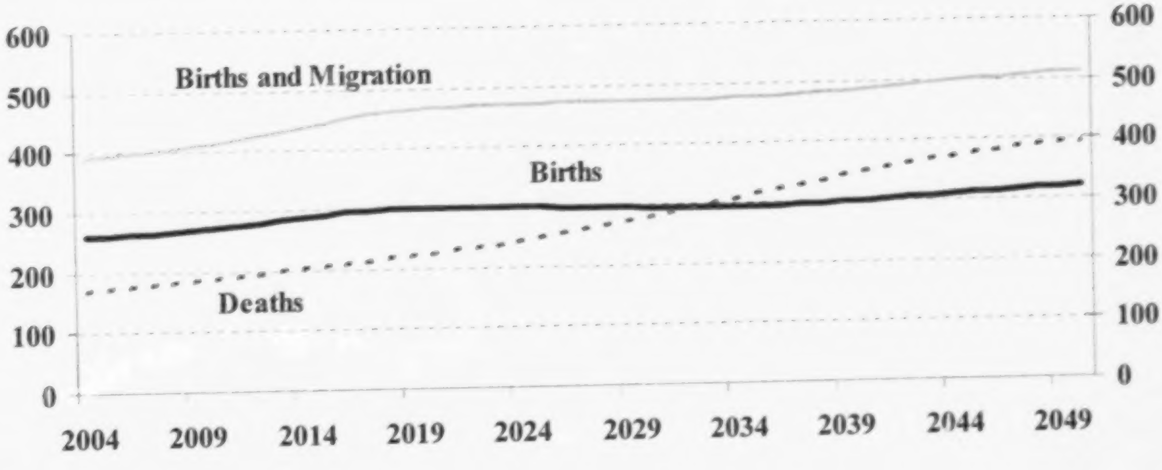


Table 29 Births, Net Migrants and Deaths for Canada less Québec
(thousands)

Year	Population 1st July	Births	Net Migrants	Deaths	Change in Population	Annual Percentage Change		
						20-64	65+	Total
						(%)	(%)	(%)
2004	24,366	261	134	172	223	1.4	1.9	0.9
2005	24,590	262	135	175	223	1.3	2.1	0.9
2006	24,813	264	137	178	224	1.2	2.2	0.9
2007	25,037	267	139	181	225	1.0	2.5	0.9
2008	25,261	270	140	184	226	1.0	2.5	0.9
2009	25,487	272	142	187	227	1.1	2.5	0.9
2010	25,714	275	144	191	228	0.9	2.8	0.9
2015	26,879	296	157	208	245	0.6	3.3	0.9
2020	28,104	300	169	228	241	0.1	3.4	0.9
2025	29,273	298	175	253	220	(0.1)	3.2	0.8
2030	30,315	294	180	285	189	0.2	1.8	0.6
2040	31,937	303	187	355	135	0.5	0.6	0.4
2050	33,190	322	192	395	119	0.2	0.7	0.4
2075	36,228	342	206	425	123	0.4	0.3	0.3

III. Economic Projections

The list of assumptions required to make projections of the various economic indices, benefit expenditures and contributions is quite extensive. The following sections cover the more important assumptions.

The economic outlook rests on the assumed evolution of the labour market, that is, labour force participation, employment, unemployment rates, inflation and the increase in average employment earnings. Rates of return on CPP assets reflect the financial markets and form part of the investment assumptions described further in section IV. All of these factors must be considered together and form part of an overall economic perspective.

A. Economic Perspective

The future revenues and expenditures of the CPP depend on many demographic and economic factors. It is important to define the individual economic assumptions in the context of a long-term overall economic perspective. For this report, a moderate but sustainable growth in the economy is assumed to persist throughout the projection period.

The actuarial examination of the CPP involves the projection of its revenues and expenditures over a long period of time. Our best judgement regarding future economic trends was used but does not take into account all of the social or technological changes that may occur over the projection period. There will always exist a certain degree of uncertainty. The projected aging of the population combined with the retirement of the baby boom generation over the next few decades will certainly create significant social and economic changes. It is possible that the evolution of the working-age population, especially the active population, will be quite different than what has been historically observed.

B. Annual Increase in Prices (Inflation Rate)

The inflation rate assumption is needed to determine the Pension Index for any given calendar year. It is also used in the determination of the annual nominal increase in average employment earnings, the Year's Maximum Pensionable Earnings (YMPE) and the nominal rates of return on investments.

Price increases, as measured by changes in the Consumer Price Index (CPI), tend to fluctuate from year to year. Over the last 50 years, the trend was generally upward through the early 1980s and downward since then. For example, the average annual increase in the CPI for the 50, 20 and 10-year periods ending in 2003 were 4.1%, 2.9% and 1.9%, respectively. Going forward, the Bank of Canada has reaffirmed its objective of keeping the inflation rate within a target range of 1% to 3% until the end of 2006.

For 2004 to 2008, it is assumed that the Bank of Canada will maintain its inflation target policy, so the assumption was set at 2.0%. This corresponds to the average forecast from various economists and falls in the middle of the Bank of Canada target. On the other hand, the ultimate assumption for price increases for 2015 and thereafter has been set at 2.7%. This is higher than has been experienced over the last decade and is in the upper range of the current Bank of Canada target range. The main reasons for the choice of an ultimate assumption of 2.7% are as follows:

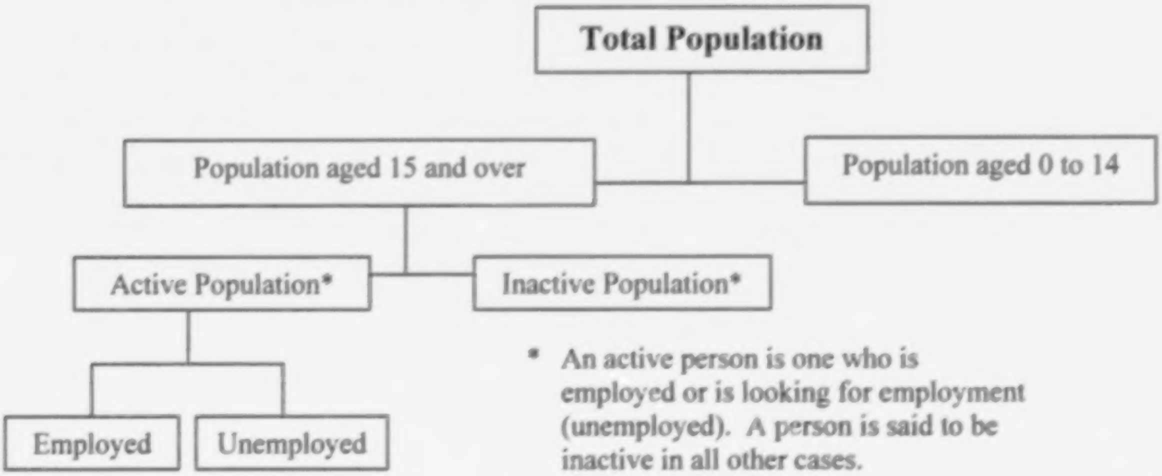
- The Bank of Canada's long-term monetary policy is known only until the end of 2006. Compared to the 75-year projection period of the CPP, the monetary policy of the Bank of Canada could be viewed as short-term.
- The expected upward pressure on real wages due to the labour shortage may create upward pressure on prices.
- There is uncertainty about future energy costs.
- In Canadian history, the longest consecutive periods with an inflation rate of about 2% are the mid-1950s to mid-1960s, and from 1992 to 2003.

Finally, for years 2008 to 2015 the inflation rate assumption is assumed to increase gradually from 2.0% to 2.7% by increments of 0.1% each year.

C. Labour Market

Chart 13 shows the main components of the labour market that are used to determine the number of earners and contributors by age, sex and calendar year.

Chart 13 Components of the Labour Market



* An active person is one who is employed or is looking for employment (unemployed). A person is said to be inactive in all other cases.

The number of earners is defined as the number of persons who had earnings during a given calendar year. The earners become contributors if they have earnings during the year at least equal to the Year's Basic Exemption (YBE) and they are between age 18 and 70. The proportion of earners and contributors assumptions (described in subsections C-3 and F below) rely on the projected active population included in this actuarial report.

1. Active Population

The overall labour force participation rates in Canada (the active population expressed as a proportion of the population aged 15 and over) from 1976 to 2003 clearly show a narrowing of the gap between male and female rates. The increase in the participation rates of females aged 15 to 69 has been significant over recent years. For males, the increase in participation rates has been significant for the younger and older age groups, that is, for those aged 15 to 24 and those aged 50 to 69.

In 1976, overall male participation was at 77.6% versus only 45.7% for females, a gap of 31.9%. This gap has narrowed to 12.0% by 2003 with male and female participation at 73.6% and 61.6%, respectively. It is assumed that females will continue to narrow the gap in participation rates but at a slower pace, with the gap gradually reducing to about 10% by 2030 and then remaining at this level thereafter. Tables 30 to 32 show the projected active population and labour force rates for Canada, while Tables 33 and 34 show the projected active population and labour force rates for Canada less Québec. Over the near term, it is assumed that females aged 50 and over will continue to increase their overall labour force participation compared to previous cohorts.

Table 30 Active Population (Canada, ages 15 and over)

Year	Population[1]			Active Population			Average Employed		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
	(thousands)			(thousands)			(thousands)		
2004	12,578	13,008	25,586	9,238	8,004	17,242	8,502	7,429	15,931
2005	12,738	13,167	25,906	9,341	8,092	17,432	8,594	7,509	16,103
2006	12,899	13,324	26,223	9,438	8,173	17,611	8,688	7,588	16,276
2007	13,054	13,479	26,533	9,524	8,244	17,768	8,776	7,659	16,435
2008	13,205	13,627	26,832	9 604	8,308	17,912	8,865	7,731	16,596
2009	13,352	13,771	27,123	9,682	8,369	18,051	8,946	7,795	16,741
2010	13,498	13,913	27,410	9,760	8,430	18,189	9,029	7,859	16,888
2015	14,127	14,530	28,658	10,049	8,698	18,747	9,339	8,143	17,482
2020	14,667	15,060	29,727	10,218	8,876	19,094	9,521	8,331	17,853
2025	15,177	15,568	30,744	10,279	8,919	19,198	9,578	8,372	17,950
2030	15,653	16,055	31,708	10,369	9,018	19,387	9,661	8,466	18,127
2040	16,407	16,879	33,286	10,668	9,292	19,961	9,940	8,723	18,663
2050	16,847	17,365	34,213	10,862	9,458	20,320	10,120	8,879	18,999

[1] Adjusted to the basis used by Statistics Canada in their labour force survey.

Table 31 Labour Force Participation Rates (Canada, ages 15 and over)

Year	Labour Force Participation Rate			Employment Rate			Unemployment Rate		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
	(%)			(%)			(%)		
2004	73.4	61.5	67.4	67.6	57.1	62.3	8.0	7.2	7.6
2005	73.3	61.5	67.3	67.5	57.0	62.2	8.0	7.2	7.6
2006	73.2	61.3	67.2	67.4	56.9	62.1	7.9	7.2	7.6
2007	73.0	61.2	67.0	67.2	56.8	61.9	7.9	7.1	7.5
2008	72.7	61.0	66.8	67.1	56.7	61.8	7.7	6.9	7.3
2009	72.5	60.8	66.6	67.0	56.6	61.7	7.6	6.9	7.3
2010	72.3	60.6	66.4	66.9	56.5	61.6	7.5	6.8	7.2
2015	71.1	59.9	65.4	66.1	56.0	61.0	7.1	6.4	6.7
2020	69.7	58.9	64.2	64.9	55.3	60.1	6.8	6.1	6.5
2025	67.7	57.3	62.4	63.1	53.8	58.4	6.8	6.1	6.5
2030	66.2	56.2	61.1	61.7	52.7	57.2	6.8	6.1	6.5
2040	65.0	55.1	60.0	60.6	51.7	56.1	6.8	6.1	6.5
2050	64.5	54.5	59.4	60.1	51.1	55.5	6.8	6.1	6.5

Table 32 Labour Force Participation Rates by Age Group (Canada)

Age Group	Males 2004	Males 2010	Males 2020	Males 2030	Females 2004	Females 2010	Females 2020	Females 2030
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
15-19	54.3	55.0	56.0	56.0	55.1	56.0	57.0	57.0
20-24	81.6	82.0	83.0	83.0	76.8	78.0	79.0	79.0
25-29	91.2	92.0	93.0	93.0	81.3	82.0	83.0	84.0
30-34	93.4	94.0	94.0	94.0	81.1	82.0	84.0	85.0
35-39	93.1	94.0	94.0	94.0	82.2	83.0	85.0	85.0
40-44	92.7	93.0	94.0	94.0	82.4	83.0	86.0	86.0
45-49	91.5	92.0	93.0	94.0	81.9	82.0	86.0	86.0
50-54	88.0	88.0	90.0	91.0	76.5	77.0	79.0	80.0
55-59	75.8	76.0	78.0	79.0	59.8	60.0	62.0	63.0
60-64	52.7	53.0	55.0	56.0	31.9	32.0	35.0	36.0
65-69	21.0	21.0	23.0	23.0	9.9	10.0	12.0	12.0
70 and Over	7.0	7.0	8.0	8.0	2.0	3.0	5.0	5.0
15-69	80.2	79.4	78.8	78.3	69.7	68.7	68.4	68.5
15 and Over	**73.4**	**72.3**	**69.7**	**66.2**	**61.5**	**60.6**	**58.9**	**56.2**

Table 33 Active Population (Canada less Québec, ages 15 and over)

Year	Population[1] Males	Population[1] Females	Population[1] Total	Active Population Males	Active Population Females	Active Population Total	Average Employed Males	Average Employed Females	Average Employed Total
	(thousands)			(thousands)			(thousands)		
2004	9,557	9,883	19,440	7,051	6,143	13,194	6,522	5,726	12,249
2005	9,687	10,015	19,701	7,139	6,220	13,359	6,600	5,795	12,395
2006	9,815	10,143	19,958	7,223	6,292	13,515	6,679	5,864	12,543
2007	9,940	10,270	20,211	7,297	6,355	13,652	6,754	5,927	12,681
2008	10,063	10,394	20,456	7,368	6,413	13,781	6,830	5,989	12,819
2009	10,183	10,514	20,697	7,438	6,470	13,908	6,900	6,046	12,946
2010	10,304	10,635	20,939	7,509	6,526	14,035	6,972	6,103	13,075
2015	10,842	11,180	22,022	7,782	6,790	14,572	7,251	6,372	13,623
2020	11,319	11,664	22,983	7,967	6,986	14,953	7,434	6,568	14,002
2025	11,777	12,133	23,910	8,066	7,067	15,133	7,527	6,643	14,169
2030	12,216	12,591	24,807	8,182	7,182	15,364	7,634	6,751	14,385
2040	12,951	13,398	26,349	8,508	7,475	15,983	7,937	7,027	14,964
2050	13,443	13,940	27,382	8,750	7,679	16,429	8,163	7,218	15,381

[1] Adjusted to the basis used by Statistics Canada in their labour force survey.

Table 34 Labour Force Participation Rates (Canada less Québec)

	Males				Females			
Age Group	2004	2010	2020	2030	2004	2010	2020	2030
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
15-19	54.6	55.3	56.3	56.3	55.8	56.9	57.8	57.8
20-24	81.3	81.9	83.0	83.0	75.9	77.2	78.2	78.2
25-29	91.2	92.0	93.0	93.0	80.9	81.7	82.7	84.0
30-34	94.0	94.6	94.3	94.3	80.7	81.7	84.0	85.0
35-39	93.2	94.3	94.0	94.0	82.1	83.0	85.0	85.0
40-44	92.6	93.0	94.0	94.0	82.2	83.0	86.3	86.0
45-49	91.7	92.3	93.0	94.0	82.2	82.3	86.5	86.3
50-54	88.2	88.0	90.0	91.0	76.8	77.3	79.3	80.3
55-59	76.6	76.7	78.6	79.6	62.4	61.6	63.2	64.0
60-64	54.8	55.0	56.9	57.4	34.5	34.0	36.9	37.6
65-69	22.4	22.4	24.3	24.2	10.9	10.7	12.6	12.6
70 and Over	7.7	7.6	8.6	8.6	2.3	3.3	5.3	5.3
15-69	80.5	80.0	79.3	78.8	70.2	69.3	69.1	69.0
15 and Over	**73.8**	**72.9**	**70.4**	**67.0**	**62.2**	**61.4**	**59.9**	**57.0**

The aging of the population exerts downward pressure on the overall labour force participation rate in Canada. The overall participation rate from Table 31 would fall from 67.4% in 2004 to 56.8% compared to 59.4% in 2050 if the 2003 participation rates by age and sex were to apply throughout the projection period. This can be explained by the projected increase in the proportion of people aged 55 to 69 outweighing the recent increase in participation in this age group, as well as the increase in the proportion of people aged 70 and over. A reduction in the overall participation rates is inevitable under these circumstances. To recognize this particular demographic trend, the projection period for purposes of projecting the participation rates has been divided into three periods: 2004 to 2010, 2010 to 2020 and 2020 to 2030.

Individuals of the baby boom generation who were born between 1945 and 1955, presently active, will be aged 55 to 65 within this decade, and this highly active cohort will continue to put upward pressure on the participation rate for the age group 55 to 64. It is projected that by 2010 the labour force participation rate of this age group (55 to 64) will increase slightly from its current level. During the period 2004 to 2010, a balance between gains in participation rates and productivity increases through the increase in average employment earnings of workers will likely result. Nonetheless, the assumed increase in labour force participation rates for those aged 50 and over is not sufficient to counteract the decrease in the overall participation rate due to the demographic shift. For this reason, participation rates for people less than age 55, especially for those aged 20 to 40, were increased somewhat. This results in labour force participation rates for those aged 15 to 69 for 2010 of 79.4% and 68.7% for males and females, respectively.

From 2010 to 2020, baby boomers born between 1955 and 1965, who are more numerous than the previous baby boomers, will be reaching the ages of 55 to 65. The first generation of boomers (1945 to 1955) will have already reached the normal retirement age, and will create downward pressure on the overall participation rate. It was thus assumed that those aged 55 to 64, during this period, would be participating more because of the increased employment opportunities due to the expected labour shortage. This change in work pattern might be expected since this generation of workers is more adaptable, flexible and better educated to prolong their work life. Since the early 1990s, young individuals less than age 35 have entered the labour force later mainly due to longer schooling. For this reason, we might expect a later exit from the labour force. It was thus assumed that participation rates for those less than age 55 would increase. Again, as for the previous period, we expect a balance between gains in participation and productivity. This results in labour force participation rates for those aged 15 to 69 for 2020 of 78.8% and 68.4% for males and females, respectively.

From 2020 to 2030, both baby boom generations will have reached the normal retirement age; combined with the projected low growth in the population, this leads to downward pressure on the ratio of active to working age persons. For this reason, the participation rates of those aged 55 to 64 are increased to partially offset the decrease in the overall participation rate. This results in labour force participation rates for those aged 15 to 69 for 2030 of 78.3% and 68.5% for males and females, respectively.

Finally for 2031 and thereafter, the participation rates are kept constant. This combined with a slow growth in the working age population results in a low rate of growth of approximately 0.3% for the active population.

2. Employment

In Canada, the annual average job creation rate has been about 1.8% since 1976. However, this rate has varied greatly, having averaged 2.2% from 1976 to 1989 but only 1.4% from 1990 to 2003. It is assumed that the job creation rate will be 1.2% in 2004, based on the most recent experience and various economic forecasts. Thereafter, the job creation rate is assumed to be around 1.0% until 2008 and then decrease gradually to 0.3% over the long term as the increase in the active population reduces the pressure on the unemployment rate. Tables 30, 33 and 35 show the projected number of employed persons for Canada and Canada less Québec.

If the job creation rate remained constant at the current level throughout the projection period, it would result in the elimination of unemployment in the context of the projected demographic situation. The unemployment rate is not expected to fall below the natural rate of unemployment without creating inflationary pressures. In this report, it is assumed that the unemployment rate will average about 7.5% from 2004 to 2008. Thereafter, the slower growth in the active population will further reduce the unemployment rate. For this reason, the unemployment rate is assumed to decrease to a level of 6.5% by about 2020 and remain at that level thereafter.

Table 35 Employment of Population
(Canada less Québec, ages 18 to 69)

Year	Population Males	Population Females	Average Employed Males	Average Employed Females	Employment Rate Males	Employment Rate Females	Proportion with Earnings (Earners) Males	Proportion with Earnings (Earners) Females
	(thousands)		(thousands)		(%)		(%)	
2004	8,350	8,334	6,274	5,513	75.1	66.1	80.1	72.8
2005	8,454	8,443	6,351	5,578	75.1	66.1	80.1	72.7
2006	8,556	8,548	6,428	5,643	75.1	66.0	80.1	72.6
2007	8,662	8,658	6,499	5,702	75.0	65.9	79.9	72.4
2008	8,771	8,770	6,572	5,760	74.9	65.7	79.8	72.2
2009	8,877	8,878	6,641	5,814	74.8	65.5	79.6	71.9
2010	8,979	8,983	6,711	5,868	74.7	65.3	79.5	71.7
2015	9,407	9,424	6,984	6,129	74.2	65.0	78.6	71.0
2020	9,633	9,661	7,146	6,305	74.2	65.3	78.3	71.0
2025	9,778	9,797	7,206	6,358	73.7	64.9	77.5	70.5
2030	9,857	9,868	7,271	6,435	73.8	65.2	77.5	70.8
2040	10,146	10,152	7,528	6,671	74.2	65.7	78.2	71.5
2050	10,530	10,557	7,747	6,859	73.6	65.0	77.4	70.5

3. Number of Earners

The number of earners for any given year, namely anyone who had employment earnings during the year, is always more than the employed population, sometimes even close to the labour force because it includes all individuals who had earnings at any given time during the year. The projected number of earners is obtained by a regression based on a highly correlated historical relationship between the number of employed persons and the number of earners over the period 1976 to 2001. Table 35 shows the average number of employed persons and the proportion of the population with earnings for Canada less Québec.

D. Rate of Increase in Average Annual Earnings

The assumed increase in average annual earnings (AAE) is used to project the earnings of CPP contributors while the assumed increase in Average Weekly Earnings (AWE) is used to increase the YMPE from one year to the next.

The real-wage differential, as measured by the difference between the increase in the AWE and the CPI, has fluctuated significantly from year to year. The trend has been generally negative since 1991. The 10-year average real-wage differential was 0.4% for the period ending in 1993 while it was -0.2% for the period ending in 2003. The average annual real-wage differential averaged 1.2% for the last 50-year period ending in 2003. Many factors influence real wage increases, including general productivity, labour demand, the move to a service economy and decreases in the average hours worked. More specifically, labour demand has significant impact on real-wage increases. Real wages are subject to downward pressure as the demand for workers decreases. On the other hand, one could expect upward pressure on wages if the size of the labour force fails to keep up with a growing economy.

The YMPE is increased according to the AWE while the CPP average earnings are increased based on historical data of the AAE. The difference between real increases in the AWE and the AAE has been relatively small over periods from 1966, 1975, and 1980 ending in 2002; that is, an absolute difference of less than 0.2% per year. Over the last few years, the difference has been more pronounced, but has started to decrease since 2000. Between 1995 and 2002, the increase in the AWE was about 1% lower than the AAE. However, over the long term it is assumed that the AWE will increase at the same rate as the AAE because of the long-term relationship between the two.

Considering these factors together with historical trends and the long-term outlook of the economy, the real increases in the AWE and AAE are assumed to converge over the next five years. The real increase in both the AWE and AAE take into account the expected upward pressure on real wages due to the expected labour shortage. The assumption is based on the expected labour shortage starting this decade, as moderated by higher participation rates at older ages and productivity gains. Table 36 below shows the assumptions regarding the annual increases in prices, average annual earnings and AWE. Taking into account the latest trend in the AWE, the real increase in AWE is assumed at -0.3% for 2004. For 2005, the real increase in AWE is assumed at 0.2% and this rate is then gradually increased to reach 1.2% by 2012. The real increase in AAE is assumed at 0.1% for 2004. For the period 2005 to 2007, the real increase in AAE is then assumed to continue to slightly outpace increases in the AWE. For 2008 and thereafter, the average annual employment earnings are increased at the same rate as for the AWE.

Table 36 Inflation, Real AAE and AWE Increases

Year	Price Increases	Real Average Annual Earnings (AAE)	Real Average Weekly Earnings (AWE)
	(%)	(%)	(%)
2004	2.0	0.1	(0.3)
2005	2.0	0.3	0.2
2006	2.0	0.5	0.4
2007	2.0	0.7	0.6
2008	2.0	0.8	0.8
2009	2.1	0.9	0.9
2010	2.2	1.0	1.0
2011	2.3	1.1	1.1
2012	2.4	1.2	1.2
2013	2.5	1.2	1.2
2014	2.6	1.2	1.2
2015+	2.7	1.2	1.2

E. Average Annual Earnings, Pensionable Earnings and Total Earnings

Average annual earnings are projected taking into account the structural demographic changes and the narrowing of the gap between average female and male employment earnings. The ratio of female to male average employment earnings stood at about 48% in 1966 and was 69% in 2002. This ratio is projected to increase to 83% by 2050. Table 37 shows the projected average annual earnings by age group and sex for selected years.

Table 37 Average Annual Earnings

	Males			Females		
Age Group	2004	2025	2050	2004	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	18,864	37,814	97,542	14,661	31,450	84,384
25-29	32,214	63,880	163,392	24,724	53,860	144,707
30-34	40,363	79,106	201,620	28,605	63,195	171,385
35-39	44,728	87,554	222,884	30,876	68,251	185,382
40-44	47,780	93,718	238,738	32,684	72,189	196,165
45-49	49,518	97,250	248,066	34,131	75,006	203,690
50-54	49,480	97,073	247,460	34,108	74,600	202,862
55-59	44,350	85,811	218,582	29,344	65,433	178,670
60-64	38,564	74,948	191,007	24,487	56,190	154,869
65-69	20,090	39,379	99,953	12,324	28,763	79,880
All Ages	**39,494**	**77,997**	**197,671**	**27,628**	**61,136**	**164,985**

Total earnings are the product of average earnings and the number of earners. Table 38 shows projected average earnings, the number of earners for each sex and the resulting total earnings and its annual percentage increase. The ultimate annual increase in total earnings is set to reach about 4.2%. This nominal increase is comprised of an ultimate inflation rate of 2.7%, real wage growth of 1.2% and population growth for the age group 18 to 69 of 0.3%.

Average pensionable earnings are computed by removing from average annual earnings (1) the earnings of those earning less than the YBE and (2) the portion of earnings in excess of the YMPE. Since earnings statistics are aggregate (by age, sex and calendar year) as opposed to individual, such removal is made using the distribution of earners and earnings. The average pensionable earnings by age, sex and calendar year used in the calculation of the average contributory earnings correspond to the average portion of individual employment earnings below the YMPE for a cohort of earners earning more than the YBE. For 2004, the YMPE and YBE are respectively $40,500 and $3,500. The YMPE is increased annually based on the average industrial aggregate wage in Canada as published by Statistics Canada. Table 39 shows the projected average pensionable earnings by age and sex for selected years.

Table 38 Total Earnings
(Canada less Québec, ages 18 to 69)

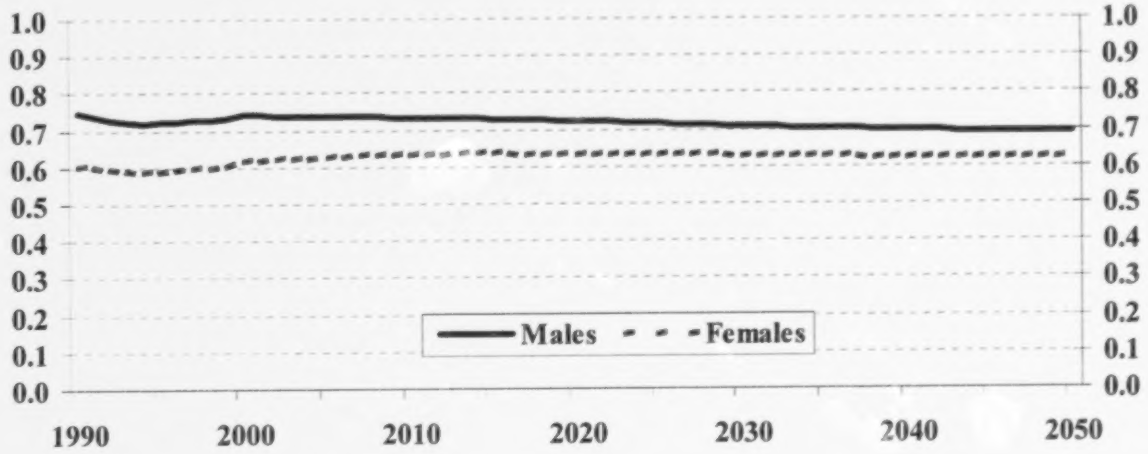
Year	Average Annual Earnings		Earners		Total Earnings	Annual Increase in Total Earnings
	Males	Females	Males	Females		
	($)	($)	(thousands)	(thousands)	($ million)	(%)
2004	39,494	27,628	6,692	6,071	432,001	3.3
2005	40,282	28,394	6,770	6,140	447,035	3.5
2006	41,168	29,233	6,849	6,209	463,471	3.7
2007	42,161	30,149	6,921	6,270	480,859	3.8
2008	43,220	31,119	6,995	6,330	499,320	3.8
2009	44,400	32,175	7,064	6,386	519,096	4.0
2010	45,705	33,324	7,135	6,442	540,752	4.2
2015	54,152	40,615	7,392	6,695	672,189	4.6
2020	64,956	49,889	7,542	6,864	832,306	4.2
2025	77,997	61,136	7,578	6,906	1,013,246	4.0
2030	93,784	74,782	7,642	6,988	1,239,219	4.2
2040	136,010	111,263	7,933	7,254	1,885,962	4.3
2050	197,671	164,985	8,146	7,439	2,837,551	4.1

Table 39 Average Pensionable Earnings
(Canada less Québec)

Age Group	Males			Females		
	2004	2025	2050	2004	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	19,833	37,907	94,863	16,436	32,756	84,188
25-29	28,366	55,088	139,272	24,493	49,399	126,963
30-34	31,352	60,943	154,853	26,323	53,303	137,379
35-39	32,524	63,384	161,556	27,216	55,233	142,683
40-44	33,145	64,751	165,414	28,065	57,125	148,102
45-49	33,451	65,410	167,267	28,747	58,389	151,468
50-54	33,139	64,629	164,896	28,678	57,964	149,823
55-59	31,219	59,978	151,033	26,531	53,765	137,436
60-64	29,551	56,046	137,254	24,672	49,948	124,611
65-69	21,156	37,076	82,724	17,849	33,162	76,970
All Ages	**29,825**	**57,851**	**145,298**	**25,305**	**51,206**	**130,868**

Chart 14 shows the evolution of the ratio of average pensionable earnings for males and females as a percentage of the YMPE. The ratio reduces in time for males mainly due to the freeze on the YBE, which has the effect of increasing the number of earners with low earnings. For females, the YBE effect is more than offset by the greater increase in their average pensionable earnings.

Chart 14 Ratio of Average Pensionable Earnings to Maximum



F. Contributions

Contributions are determined by multiplying the number of contributors by the product of the average contributory earnings and the contribution rate.

1. Proportion of Contributors

In respect of a given calendar year, one of the conditions to be a contributor is to have employment earnings exceeding the YBE. A proportion of contributors is accordingly determined by multiplying the proportion of earners by the complement of the fraction of earners earning less than the YBE. This fraction was determined for each age, sex and calendar year by expressing the YBE as a percentage of average employment earnings and using the distribution of earners and their earnings. These distributions were obtained from earnings statistics and are assumed to remain fixed at their adjusted 2002 distribution. Table 40 presents the proportion of contributors by selected age groups and years for males and females, respectively.

Table 40 Proportions of Contributors by Age Group

	Males			Females		
Age Group	2004	2025	2050	2004	2025	2050
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	77.5	83.1	85.6	72.9	81.0	84.8
25-29	81.0	85.4	87.3	72.3	78.8	82.2
30-34	84.6	87.0	88.2	72.9	79.1	81.6
35-39	87.6	90.1	91.0	77.0	83.0	84.9
40-44	82.4	84.9	85.5	75.1	81.3	82.6
45-49	85.7	88.7	90.0	77.6	84.1	85.4
50-54	79.4	83.1	84.6	71.3	76.3	78.5
55-59	72.2	77.0	79.6	58.1	61.1	63.9
60-64	45.9	50.6	53.5	28.7	33.3	36.1
65-69	8.7	11.1	12.5	4.4	6.5	7.6
All Ages	**74.9**	**74.4**	**76.1**	**65.6**	**66.5**	**68.8**

2. Average Contributory Earnings

Average contributory earnings were computed in respect of a given age, sex and year cell of contributors by subtracting the YBE from the average pensionable earnings as computed above. Table 41 shows the resulting average contributory earnings by age group and sex for selected years.

Table 41 Average Contributory Earnings

	Males			Females		
Age Group	2004	2025	2050	2004	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	16,333	34,407	91,363	12,936	29,256	80,688
25-29	24,866	51,588	135,772	20,993	45,899	123,463
30-34	27,852	57,443	151,353	22,823	49,803	133,879
35-39	29,024	59,884	158,056	23,716	51,733	139,183
40-44	29,645	61,251	161,914	24,565	53,625	144,602
45-49	29,951	61,910	163,767	25,247	54,889	147,968
50-54	29,639	61,129	161,396	25,178	54,464	146,323
55-59	27,719	56,478	147,533	23,031	50,265	133,936
60-64	26,051	52,546	133,754	21,172	46,448	121,111
65-69	17,656	33,576	79,224	14,349	29,662	73,470
All Ages	**26,325**	**54,351**	**141,798**	**21,805**	**47,706**	**127,368**

3. Total Contributory Earnings

Contributory earnings for a given age, sex and year cell are calculated as the product of the proportion of contributors, the average contributory earnings computed as above, and the population for that cell. Total contributory earnings for any given year were obtained by summing contributory earnings computed for each age and sex cell for that year.

Total contributory earnings are then adjusted to take into account the non-refundable portion of employer contributions arising generally in respect of (1) employees with multiple employers during a given year, (2) employees earning less than the YBE during a given year, and (3) employees who work only part of the year and do not have full access to the YBE. The annual report on contributors published by Social Development Canada (SDC) and information from the Canada Revenue Agency (CRA) on CPP contribution refunds were used to calculate the adjustment. The adjustment is about 1.9% in 2002 and gradually reduces to 1.8% over the projection period to take into account the freeze on the YBE at $3,500 and the portion of the adjustment related to those earners earning less than the YBE. The contributory earnings were further reduced to account for employer contribution refunds in the case of corporate restructuring as per the amendments of Part 4 of Bill C-30.

Annual contributions are obtained as the product of the adjusted contributory earnings and the contribution rate. The contribution rate is set by law at 9.9% for years 2003 and thereafter. Table 42 presents the components of total adjusted contributory earnings and the YMPE.

Table 42 Total Adjusted Contributory Earnings

	Average Contributory Earnings			Contributors		Total Adjusted Contributory Earnings	Annual Increase in Total Contributory Earnings
Year	Males	Females	YMPE	Males	Females		
	($)	($)	($)	(thousands)	(thousands)	($ million)	(%)
2004	26,325	21,805	40,500	6,251	5,465	288,970	3.2
2005	26,793	22,312	41,100	6,331	5,541	298,643	3.3
2006	27,379	22,904	41,900	6,412	5,616	309,772	3.7
2007	28,087	23,587	42,900	6,487	5,685	322,095	4.0
2008	28,859	24,322	44,000	6,563	5,753	335,376	4.1
2009	29,705	25,119	45,200	6,637	5,818	349,556	4.2
2010	30,622	25,980	46,500	6,712	5,883	364,926	4.4
2015	36,677	31,563	55,100	7,003	6,191	460,396	4.9
2020	44,713	38,877	66,700	7,193	6,415	581,181	4.6
2025	54,351	47,706	80,800	7,275	6,515	718,640	4.3
2030	65,849	58,221	97,800	7,385	6,655	888,999	4.3
2040	96,590	86,161	143,400	7,745	7,018	1,376,157	4.4
2050	141,798	127,368	210,300	8,012	7,272	2,097,524	4.2

IV. Investment Assumptions

A. Investment Strategy

The CPP assets are invested in three major components: the CPP Account, the CPP Fund, and the CPP Investment Board assets. Short-term assets are invested through the Account. Loans to the provinces correspond to 20-year bonds and are invested in the CPP Fund. A mix of other assets is invested through the CPP Investment Board in fixed and variable income securities.

The CPP Investment Board invests funds according to its own investment policies, which take into account the needs of contributors, beneficiaries and financial market constraints. The investments have been grouped into two broad categories: fixed and variable income securities. Fixed income securities consist of bonds, which are usually a mix of federal, provincial, and corporate bonds. Variable income securities consist of Canadian, U.S. and foreign equities, as well as real return assets such as real estate and infrastructure. In their 2004 Annual Report, the CPP Investment Board stated that their anticipated asset mix in 2006 is 65% variable income and 35% fixed income. It is assumed that the 65% invested in variable income securities is composed of 25% Canadian equity, 30% U.S. and foreign equity, and 10% real estate and infrastructure. The 35% invested in fixed income securities is assumed to be composed of 34.5% bonds, including marketable and non-marketable bonds and 0.5% short-term investments, such as cash.

As the CPP matures, it is assumed that the CPP Investment Board will increase their investments in fixed income securities. For this reason, the ultimate assumed asset mix of the CPP Investment Board is 55% variable income and 45% fixed income. It is assumed that the 55% invested in variable income securities is composed of 15% Canadian equity, 30% U.S. and foreign equity, and 10% real estate and infrastructure. The 45% invested in fixed income securities is composed of 44.5% bonds, including marketable and non-marketable bonds, and 0.5% short-term investments. The ultimate asset mix is achieved in 2025.

When deriving the assumed asset mix of the CPP, consideration was given to the asset mix policy of other major Canadian pension plans. Table 43 shows the assumed asset mix at the end of the year throughout the projection period.

Table 43 Asset Mix

			Canada Pension Plan Investment Board					
Year	CPP Account	CPP Fund	Canadian Equity	U.S. and Foreign Equity	Marketable Bonds	Non-Marketable Bonds	Real Estate & Infrastructure	Short Term
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2004	5.3	28.6	36.7	19.8	0.0	8.2	0.9	0.5
2005	-	13.4	37.3	26.0	4.3	16.8	1.7	0.5
2006	-	2.7	32.9	29.2	10.5	21.4	2.9	0.5
2007	-	-	31.0	30.0	14.9	19.6	4.0	0.5
2008	-	-	29.0	30.0	18.3	16.2	6.0	0.5
2009	-	-	27.0	30.0	20.9	13.6	8.0	0.5
2010	-	-	25.0	30.0	23.2	11.3	10.0	0.5
2015	-	-	25.0	30.0	28.3	6.2	10.0	0.5
2020	-	-	25.0	30.0	31.0	3.5	10.0	0.5
2025	-	-	15.0	30.0	43.1	1.4	10.0	0.5
2030	-	-	15.0	30.0	44.2	0.3	10.0	0.5
2033+	-	-	15.0	30.0	44.5	-	10.0	0.5

B. Investment Earnings

Investment earnings are produced by each of the three main components of the CPP assets, i.e. the CPP Account, the CPP Fund and the CPP Investment Board assets. In general, investment earnings are the product of the market value of a specific component and the projected nominal rate of return (which is obtained by adding the applicable projected real rate of return as described in subsection C below to the projected inflation rate) of that component.

The investment earnings of the CPP Investment Board are based on the assumed real rate of return applicable to each type of asset, projected inflation, and on the long-term investment policy and strategy. The investment earnings are also adjusted downward to recognize investment expenses. Based on the experience of the CPP Investment Board and other large public pension plans, the investment expenses are assumed to reduce the gross rate of return by 0.07% for 2004 and thereafter.

C. Real Rates of Return

Real rates of return are required for the projection of revenues arising from investment earnings. They are assumed for each year in the projection period and for each of the main components of CPP assets, namely the CPP Account (the Operating Balance), the CPP Fund (loans to provinces), and the assets under the management of the CPP Investment Board. All of the real rates of return described in this subsection are net of investment expenses.

1. Real Rate of Return on CPP Account (Operating Balance)

The CPP Account is comprised of an Operating Balance and short-term investments. The Operating Balance is maintained at a level to meet the anticipated benefit payments and administrative charges from the Account for the next three-month period. These funds are not invested in provincial securities or equities but earn interest on the average daily balance of the reserve. Beginning in September 2004, the CPP Account held by the federal Department of Finance will be transferred to the CPP Investment Board at a rate of 1/12th per month. The transfer will take one year to complete. Since the CPP Account is generally invested in short-term securities, it is assumed to be totally reinvested yearly and to earn a real rate of return of 0.5% for 2004 and 1.0% for 2005.

2. Rollover Rate and Real Rate of Return on CPP Fund (Loans to Provinces)

The CPP Fund at the end of 2003 was composed of 20-year bonds consisting of loans made to the provinces. The provinces are allowed to rollover, at maturity, any bonds that were purchased prior to the CPP amendments (which came into effect on 1 January 1998) for one more 20-year term. As at 31 December 2003, 53% of loans available for rollover had been rolled over. The rollover experience during the period of 1999 to 2003 for loans was used to determine that the overall pre-1998 loan rollover rate would be approximately 55% for years 2004 and thereafter. Beginning in May 2004, the CPP Fund held by the federal Department of Finance will be transferred to the CPP Investment Board at a rate of 1/36th per month. The transfer will take three years to complete.

The applicable interest rate on rollover bonds is set at the market rate for provincial bonds issued by the given province. On the basis of the average long-, medium- and short-term experience of the spread between the annual yield on federal and provincial long-term investments, the current outlook of the economy and data on rollovers since 1999, a spread over the federal yield was determined for each province. The ultimate real federal yield is set at 2.85%. The weighted average spread for all provinces is approximately 40 basis points. Therefore, an ultimate yield of approximately 3.25% for provincial rollover bonds was assumed for 2015 and thereafter. For the period from 2004 to 2015, the assumed yields for provincial rollover bonds were derived by interpolation between the assumed 2004 real rate of 2.81% and the ultimate real rate of 3.25% for 2015.

The real rate of return of this non-marketable bond portfolio is calculated by taking into consideration any coupon payments made throughout the year, as well as the change in the market value of the portfolio from the beginning to the end of the year.

3. Real Rate of Return on Assets Under the Management of the CPP Investment Board

As discussed earlier, CPP Investment Board assets are invested in two broad categories of investments: variable income securities and fixed income securities. The projected real rates of return on fixed and variable income assets have both been determined by taking into consideration various economic forecasts. This outlook was based on the fact that over the long term, real interest rates are expected to remain relatively low in the future, as their recent higher level was consequential to growing inflation pressure that would not be sustained in the future. The projected real rates of return for the different types of investments also reflect that projections are over a 75-year horizon and that they are generally consistent with the long-term averages of real rates of return ending in 2003.

Variable Income Securities

Most CPP Investment Board assets are currently invested in variable income securities, specifically in Canadian, U.S. and foreign stock indexed funds, as well as real return assets, such as real estate and infrastructure. In the derivation of the real rates of return for these variable return investments, consideration was given to the long-term real rates of return of the S&P/TSX, S&P 500 and MSCI World (excluding U.S.) stock indices, as well as real rates of return experienced during the first half of 2004.

Based on recently observed returns for the first six months of 2004, Canadian equities are projected to achieve a real rate of return of 5.0% for 2004, while for 2005 and onward a rate of 4.6% is assumed. In comparison, the 35-year historical average of the S&P/TSX total annual real return ending 31 December 2003 is 4.6%, while the 50-year historical average is 6.3%. Based on recently observed returns for the first six months of 2004, U.S and foreign (i.e. other than U.S.) equities are projected to achieve a real rate of return of 0.5% in 2004 and of 5.0% for 2005 onward. In comparison, the 35-year historical average real rate of return of the S&P 500 is 6.2%, while the 50-year historical average is 8.2%. Real estate and infrastructure are projected to achieve a real rate of return of 4.0% during the projection period. The Russell Canadian Property Index has an average real rate of return of 5.2% over the last 30 years.

Fixed Income Securities

The CPP Investment Board currently has very few investments in fixed income assets due to the dominance of this type of investment in the CPP Fund and the existence of the CPP Account (Operating Balance). It is expected that fixed income assets will represent an important portion of the CPP Investment Board investments in the future when the CPP Account and CPP Fund are transferred to the CPP Investment Board. The assumed asset mix in 2010 is 65% in variable income securities and 35% in fixed income securities, such as bonds. In 2025, it is assumed that an asset mix of 55% in variable income securities and 45% in fixed income securities will be achieved. The percentage of fixed income securities held is assumed to increase by this time in order to attain more stability in investment income to pay benefits. Therefore, a lower risk investment strategy may be desired.

As the CPP Fund components come to maturity over the next 30 years, it is assumed that the proceeds will be invested in fixed income investments, such as bonds, and that this marketable bond portfolio will consist of federal, provincial, and corporate bonds. It is assumed that when the CPP Investment Board begins purchasing marketable bonds, the proportion already invested in the CPP Fund and the desired bond mix will be taken into consideration. Over the next few years, it is assumed that corporate bonds will be purchased due to the transfer of the CPP Fund to the CPP Investment Board. As the bonds in the CPP Fund mature, it is assumed that federal, provincial, and corporate bonds will be purchased. Lastly, it is also assumed that the ultimate marketable bond mix (achieved in 2033, when the non-marketable bond portfolio matures) will be 20% federal, 40% provincial, and 40% corporate.

As discussed earlier, the ultimate yield on long-term federal bonds is 2.85%. The spread over the federal bond yield is assumed to be 40 basis points for provincial bonds and 100 basis points for corporate bonds. The real rate of return for the marketable bond portfolio is calculated for each year using the proportion invested in each bond type and the bond yield. An ultimate real rate of return of 3.4% is calculated for the bond portfolio. Table 44 summarizes the assumed real rates of return by asset type throughout the projection period.

Table 44 Real Rates of Return by Type of Assets

			Canada Pension Plan Investment Board					
Year	**CPP Account**	**CPP Fund**	**Canadian Equity**	**U.S. and Foreign Equity**	**Marketable Bonds**	**Non-Marketable Bonds**	**Real Estate & Infrastructure**	**Short Term**
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2004	0.5	6.4	5.0	0.5	3.4	6.4	4.0	0.5
2005	1.0	6.0	4.6	5.0	3.5	6.0	4.0	1.0
2006	-	5.9	4.6	5.0	3.5	5.9	4.0	1.5
2007	-	5.7	4.6	5.0	3.5	5.7	4.0	1.5
2008	-	-	4.6	5.0	3.4	5.5	4.0	1.5
2009	-	-	4.6	5.0	3.4	5.1	4.0	1.5
2010	-	-	4.6	5.0	3.4	4.6	4.0	1.5
2015	-	-	4.6	5.0	3.5	3.3	4.0	1.5
2020	-	-	4.6	5.0	3.4	3.2	4.0	1.5
2025	-	-	4.6	5.0	3.4	2.9	4.0	1.5
2030	-	-	4.6	5.0	3.4	3.1	4.0	1.5
2033+	-	-	4.6	5.0	3.4	- *	4.0	1.5

* The non-marketable bonds portfolio will mature by 2033.

D. Rates of Return Calculation

The rates of return on the CPP Investment Board fixed income securities takes into account the coupons and the market value fluctuations due to changes in interest rates. For the CPP Investment Board variable income securities, the rates of return include dividends from the equities, market value fluctuations, and variations in currency exchange for non-Canadian equities. No distinction is made between realized and unrealized capital gains. These rates of return are described above in subsection C.

E. Overall Rate of Return on Assets

The assumed rate of return on the total assets was derived as the weighted average rate of return on all types of assets, using the market value of the assets as weights. The resulting rates are shown in Table 45.

Table 45 Rates of Return on CPP Assets

Year	Nominal	Real
	(%)	(%)
2004	6.4	4.4
2005	7.0	5.0
2006	7.0	5.0
2007	6.8	4.8
2008	6.7	4.7
2009	6.6	4.5
2010	6.6	4.4
2015	6.9	4.2
2020	6.9	4.2
2025	6.8	4.1
2030+	6.8	4.1

V. Benefit Expenditures

The actuarial approach used for projecting the future benefits paid is based on macro-simulation, which means that the projections rely on grouped data. The amount of benefit expenditures is determined by taking into account the administrative agreement between the Canada Pension Plan and the Québec Pension Plan for beneficiaries who contributed to both plans.

The average initial annual retirement pension of all persons born in a given calendar year split by sex is obtained by summing over the contributory period of this cohort the annual products of the proportion of contributors and the average pensionable earnings deemed to apply to the given cohort and dividing this sum by the number of years included in the contributory period.

All benefit projections are made using 1966 as the starting point instead of the beginning (2004) of the statutory valuation period. This is done for the following reasons:

- The valuation methodology can be validated for the pre-valuation years (1966 to 2003) by comparing the projected values (contributions, benefits, beneficiaries, etc.) for these years with actual results.
- The projection of those benefits already in pay as at the valuation date (31 December 2003) is fully integrated with that of benefits emerging after that date, thus ensuring full consistency of the various valuation processes.

The estimated number of beneficiaries and average pensions payable as at 31 December 2003 is shown in Table 46.

Table 46 Pensions Payable as at 31 December 2003

	Number of Beneficiaries		Average Monthly Benefit	
Benefit Type	**Males**	**Females**	**Males**	**Females**
	(in thousands)		$	$
Retirement	1,504	1,465	546	327
Survivor				
- Aged less than 65	46	188	285	350
- Aged 65 and over	75	610	113	303
Disability	156	160	805	695

	Number of Beneficiaries	Average Monthly Benefit
Benefit Type	**Males and Females**	**Males and Females**
	(in thousands)	$
Orphans	80	187
Disabled Contributor's Child	97	187

A. Adjustments to Pensionable Earnings and Proportion of Contributors

The effect of the credit-splitting of unadjusted pensionable earnings between spouses in the event of marital union breakdown is accounted for by adjusting projected proportions of contributors and average pensionable earnings of the respective spouses.

The average pensionable earnings are also adjusted to take into account retirement pensions emerging prior to age 65. These pensions have the effect of reducing the amount of contributions that would otherwise have been made to the CPP. Such effect is already taken into account in the average pensionable earnings described earlier for contributory earnings purposes (see Table 39). For benefit computation purposes, however, such effect must be removed in respect of contributors not yet retired at a given age before 65. The resulting adjusted proportions of contributors and average pensionable earnings for benefit computation purposes appear in Tables 47 and 48, respectively.

Table 47 Proportions of Contributors
(adjusted for benefit computation purposes)

	Males			Females		
Age Group	**2004**	**2025**	**2050**	**2004**	**2025**	**2050**
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	78.6	84.0	86.5	76.4	83.2	86.3
25-29	83.3	87.2	89.1	78.0	83.2	85.9
30-34	86.9	89.1	90.2	79.3	83.9	85.8
35-39	89.6	91.9	92.6	82.3	86.9	88.4
40-44	85.1	87.4	87.9	79.7	84.8	85.9
45-49	87.7	90.4	91.5	81.3	86.7	87.9
50-54	81.4	84.8	86.2	74.6	79.1	81.1
55-59	73.7	78.3	80.9	61.2	64.2	66.9
60-64	46.8	51.5	54.4	30.8	35.5	38.3
65-69	8.7	11.1	12.5	4.4	6.5	7.6
All Ages	**76.7**	**75.9**	**77.4**	**69.5**	**69.3**	**71.4**

Table 48 Average Pensionable Earnings
(adjusted for benefit computation purposes)

	Males			Females		
Age Group	2004	2025	2050	2004	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	19,282	37,183	93,406	16,074	32,316	83,364
25-29	26,830	52,821	134,347	23,576	48,021	124,005
30-34	29,464	58,035	148,186	25,474	51,953	134,294
35-39	30,755	60,725	155,423	26,632	54,352	140,667
40-44	31,269	61,850	158,515	27,298	55,865	144,915
45-49	31,990	63,261	162,332	28,181	57,559	149,468
50-54	31,702	62,362	159,648	27,980	56,777	147,029
55-59	29,939	57,894	146,220	25,790	52,289	133,941
60-64	30,138	57,124	140,293	25,511	51,380	128,569
65-69	23,234	40,755	90,890	19,172	35,652	82,789
All Ages	**28,472**	**55,939**	**141,041**	**24,697**	**50,311**	**128,845**

B. Benefit Eligibility Rates

As mentioned in Appendix A (Plan Provisions), the eligibility for benefits varies according to the type of benefit involved. Benefit eligibility rates are used in the valuation process for the computation of historical retirement rate proportions, disability incidence rates and benefits of all types.

Benefit eligibility rates for retirement, disability and survivor benefits are computed using regression formulae that were developed to closely reproduce historical eligibility rates as observed from the CPP records of earnings data for the period 1966 to 2002. The projected eligibility rates take into account the applicable eligibility rules for each type of benefit, the proportions of contributors and the length of the contributory period for existing and future cohorts of earners.

The disability and survivor benefit eligibility rates developed above must be adjusted for purposes of computing the earnings-related portion of these two types of benefits. Since eligibility rules for disability and survivor benefits are more stringent than for retirement pensions, contributors eligible for either a disability or survivor benefit have, on average, fewer years of zero earnings than contributors solely eligible for a retirement pension. Table 49 shows the resulting eligibility rates for the various benefit types by sex for selected years.

Table 49 Benefit Eligibility Rates by Type of Benefit

	Retirement Benefit Eligibility Rate at Age 65		Death Benefit Eligibility Rate at Age 65	
Year	**Males**	**Females**	**Males**	**Females**
2004	1.03	0.90	0.91	0.54
2005	1.03	0.91	0.92	0.56
2006	1.03	0.92	0.92	0.57
2007	1.03	0.93	0.92	0.58
2008	1.04	0.94	0.93	0.59
2009	1.03	0.94	0.93	0.61
2010	1.02	0.95	0.93	0.62
2015	1.03	0.96	0.94	0.67
2020	1.02	0.97	0.94	0.71
2025	1.01	0.97	0.94	0.73
2030	1.01	0.97	0.93	0.74
2040	1.01	0.98	0.92	0.76
2050	1.02	0.99	0.92	0.77

	Death Benefit Eligibility Rate at Ages 20-64		Disability Benefit Eligibility Rate at Ages 20-64	
Year	**Males**	**Females**	**Males**	**Females**
2004	0.78	0.69	0.76	0.66
2005	0.78	0.69	0.76	0.67
2006	0.78	0.69	0.76	0.67
2007	0.78	0.70	0.76	0.67
2008	0.78	0.70	0.76	0.67
2009	0.78	0.70	0.76	0.67
2010	0.79	0.71	0.76	0.67
2015	0.79	0.72	0.77	0.69
2020	0.80	0.74	0.78	0.71
2025	0.81	0.76	0.78	0.72
2030	0.82	0.77	0.80	0.73
2040	0.83	0.78	0.80	0.74
2050	0.84	0.79	0.80	0.74

C. Average Earnings-Related Benefit Factor

The average earnings-related benefit factor is designed to produce, when multiplied by the eligible population and the Pension Index of a given calendar year successively for both sexes and all relevant ages, the total emerging annual earnings-related benefit expenditure for that year.

The gross (i.e. before taking into account the dropout provisions and earnings index) average earnings-related benefit factor is determined by sex and calendar year for each attained age from 18 to 70 as the product of the retirement benefit proportion (25%) and the ratio of:

- the sum over all the years in the elapsed contributory period (i.e. from age 18 to the attained age) of the ratio in each year of:
    - the product of the proportion of contributors and the average pensionable earnings (both components adjusted for benefit computation purposes),
    - to the YMPE

- to the number of years in the elapsed contributory period at the attained age.

The earnings-to-YMPE ratios that have to be dropped from the numerator of the gross benefit factor described above, in respect of an individual, are the lowest ratios for a number of years equal to the sum of the child-rearing period, disability period and 15% of the residual contributory period. However, since the general approach is based on macro-simulation (aggregate), there is no explicit way of determining the lowest ratios for each individual that would have to be dropped from the numerator to take into account the dropout provisions. Consequently, a formula was developed to help determine the lowest earnings ratios that can be dropped. The formula is based on the length of the contributory period, the basic dropout percentage, the child-rearing period expressed as a percentage of the elapsed contributory period and the average proportion of contributors over the elapsed contributory period.

The average period that has to be dropped from the contributory period (i.e. the denominator of the gross benefit factor described above) is computed as the sum of the three periods determined in respect of the disability, child-rearing and 15% dropout provisions.

The average earnings-related benefit factor is finally determined by multiplying the gross factor above, adjusted for the dropout provisions, by the earnings index, which takes into account the wage indexation provision underlying the calculation of the initial rate of a benefit when it emerges.

Table 50 shows the resulting projected average retirement earnings-related benefit factor by sex for various cohorts of contributors reaching the age of 65 in selected years over the projection period.

Table 50 Average Retirement Benefit Factor as Percentage of Maximum

Year	Retirement Benefit Factor for Cohort Aged 65 Males	Females
	(%)	(%)
2004	77	50
2005	76	51
2006	77	52
2007	76	53
2008	77	54
2009	76	54
2010	74	54
2015	73	57
2020	71	57
2025	68	56
2030	66	56
2040	66	58
2050	66	59

D. Retirement Expenditures

For each cohort of contributors reaching a given retirement age from 60 to 70 in each of the calendar years from 1967 to 2075, an average retirement benefit factor was computed, by age, sex and calendar year of emergence of the pension, as the product of:

- the assumed proportion of contributors electing to opt for their retirement benefit;
- the actuarial adjustment factor in connection with the flexible retirement age provision; and
- the average earnings-related benefit factor.

The assumed proportions, by age, sex and calendar year, of contributors electing to start receiving the retirement pension at a given age were determined by taking account of the future assumed work patterns of earners aged 60 and over and the corresponding CPP experience for 1996 to 2003. These proportions correspond to the ratio of the number of emerging retirement beneficiaries to the product of the population and the retirement benefit eligibility rate.

A small proportion of contributors elect to start receiving the retirement pension after age 65. For each year after 2003, the retirement election rates for ages 60 to 64 and 66 to 69 were determined by using the observed averages over the last five years. For ages 60 and 65, the observed rates for year 2003 are adjusted until 2030 to reflect the anticipated effects of the labour shortage on retirement patterns. For this purpose, the retirement rate at age 60 is reduced by one third of the difference between the assumed participation rate at ages 60 to 64 in 2030 and the corresponding participation rate in 2003. The retirement rate at age 65 is then increased by the amount of reduction applied at age 60. With this approach, it is implicitly assumed that all eligible contributors will have applied for the retirement pension by age 70. Table 51 shows the projected retirement rates by age for males and females, respectively.

The retirement pension expenditure for each year following the year of benefit uptake for a given age, sex and cohort was computed as the product of:

- the population of retirement beneficiaries at emergence;
- the relevant annualized average rate of retirement pension payable during the year of emergence (described above);
- the probability of survival from the emergence age to the attained age; and
- the Pension Index, which recognizes the annual CPI increase to a pension each 1 January after its emergence.

Table 51 Retirement Rates

	Retirement Age Distribution for Cohort Aged 60 in 2004		Retirement Age Distribution for Cohort Aged 60 in 2030	
Age	**Males**	**Females**	**Males**	**Females**
	(%)	(%)	(%)	(%)
60	33.1	39.5	32.0	38.2
61	5.9	6.7	5.9	6.7
62	5.5	5.8	5.5	5.8
63	5.2	5.0	5.2	5.0
64	6.9	8.4	6.9	8.4
65	40.5	32.8	41.6	34.1
66	0.8	0.4	0.8	0.4
67	0.6	0.5	0.6	0.5
68	0.5	0.3	0.5	0.3
69	0.5	0.3	0.5	0.3
70	0.5	0.3	0.5	0.3
Total	**100.0**	**100.0**	**100.0**	**100.0**

The mortality rates vary by calendar year, sex, age and level of emerging pension. The mortality rates were developed based on the 1966 to 2000 CPP retirement beneficiaries' mortality experience. The resulting mortality rates and life expectancies appear in Tables 52 and 53 below.

Table 52 Mortality Rates of Retirement Beneficiaries
(annual deaths per 1,000)

	Males				Females			
Age	2004	2025	2050	2075	2004	2025	2050	2075
60	5.2	3.6	3.1	2.6	3.5	2.7	2.4	2.0
65	14.6	10.3	9.0	7.8	8.1	6.6	5.7	5.0
70	24.4	18.3	16.1	14.3	13.7	11.6	10.3	9.0
75	39.4	30.7	27.2	24.0	23.1	19.5	17.1	15.1
80	64.9	53.3	47.2	41.7	40.7	35.1	30.9	27.3
85	105.6	94.3	84.6	76.0	72.0	66.9	59.9	53.7

Table 53 Life Expectancy of Retirement Beneficiaries (with improvements)

	Males				Females			
Age	2004	2025	2050	2075	2004	2025	2050	2075
60	22.9	24.0	25.0	26.0	26.2	27.1	28.1	29.0
65	18.3	19.5	20.4	21.3	21.6	22.5	23.4	24.3
70	14.4	15.4	16.3	17.1	17.3	18.1	19.0	19.8
75	11.0	11.9	12.6	13.3	13.4	14.2	14.9	15.6
80	8.1	8.7	9.3	9.9	10.0	10.5	11.2	11.8
85	5.8	6.2	6.6	7.1	7.2	7.5	8.0	8.5

The amounts of all retirement pensions payable during any given past or future calendar year were obtained by simply summing the annual expenditure applying for the given calendar year as described above, in respect of all age and sex cohorts having emerged in the given and each of the previous calendar years.

Based on comparisons of actual results and projections for 1966 to 2003, experience adjustment factors at emergence were applied to all future emerging retirement pensions calculated using the methodology described above and are shown in Table 54. Table 55 shows the projected number of new retirement beneficiaries along with their projected average monthly retirement benefit by sex and year.

Table 54 Retirement Benefit Experience Adjustment Factors

	Age at Emergence		
	60-65	66 and Over	All Ages
Males	1.01	0.58	0.99
Females	0.96	0.59	0.94

Table 55 New Retirement Pensions

	Number of Beneficiaries			Average Monthly Pension		
Year	Males	Females	Total	Males	Females	Total
				($)	($)	($)
2004	104,806	99,468	204,274	543.22	340.07	444.30
2005	107,348	102,421	209,769	547.77	348.57	450.51
2006	113,733	109,482	223,215	558.84	360.31	461.46
2007	125,900	123,015	248,915	565.17	370.88	469.15
2008	131,484	128,059	259,544	576.82	383.46	481.41
2009	133,258	131,006	264,263	583.99	396.23	490.91
2010	136,926	134,906	271,832	593.46	408.10	501.47
2015	163,765	164,140	327,905	678.12	494.00	585.96
2020	186,062	185,719	371,780	792.98	596.66	694.91
2025	198,610	196,108	394,717	932.52	718.00	825.94
2030	189,297	186,843	376,140	1,106.97	874.93	991.71
2040	189,248	188,362	377,610	1,612.54	1,311.18	1,462.21
2050	211,133	209,866	420,999	2,385.97	1,965.96	2,176.59

E. Disability Expenditures

The general approach used to estimate disability pensions was to compute the initial value of benefits emerging by age and sex each year starting in 1970 as the product of:

- the actual or assumed disability incidence rate;
- the probability of being eligible for disability benefits;
- the annual amount of benefit; and
- the corresponding population.

The initial value of the earnings-related benefit by age and sex is equal to 75% of the average retirement earnings-related benefit factor adjusted upward to reflect the fact that disability eligibility rules are more stringent than for retirement. Finally these emerging benefits are then projected by age and sex to each future year until termination (due to recovery, death, or attainment of age 65) using the disability termination rates for the appropriate duration and the Pension Index. Historical and projected disability incidence rates are summarized in Chart 15 and Table 56.

Chart 15 Disability Incidence Rates
(per 1,000 eligible)

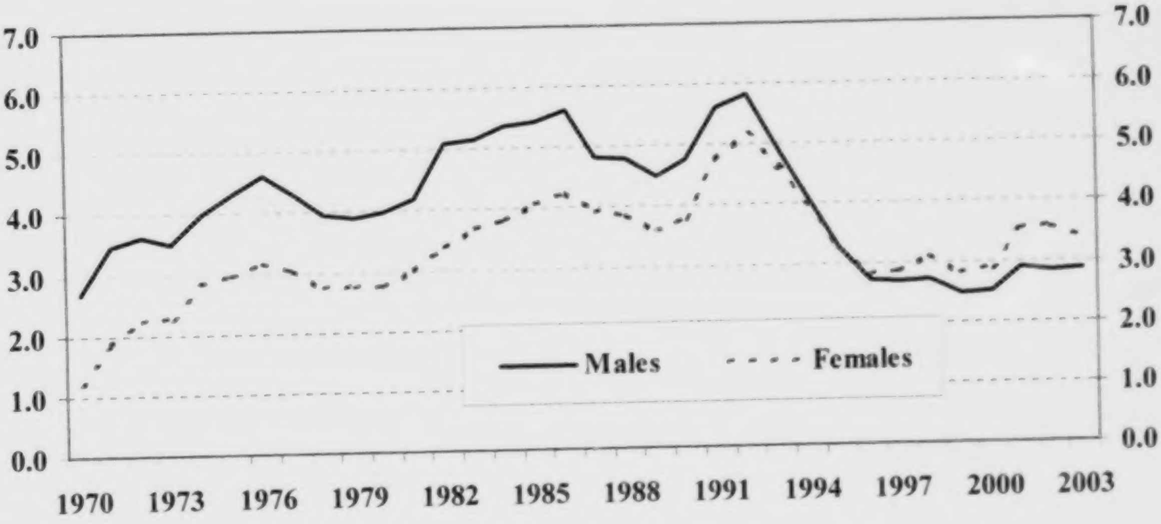


Table 56 Ultimate Disability Incidence Rates
(per 1,000 eligible)

Age	Males	Females
25	0.37	0.27
30	0.63	0.87
35	1.06	1.66
40	1.57	2.29
45	2.46	3.44
50	4.00	5.28
55	8.77	7.30
60	16.38	10.79
61	17.20	11.74
62	17.64	12.76
63	17.69	13.85
64	9.37	7.47
All Ages	**3.25**	**3.50**

It can be seen from Chart 15 that incidence of disability (i.e. the number of new cases as a proportion of the eligible population) gradually increased from 1980 to the mid-1990s. The annual rate of change in incidence rates was particularly acute between 1989 and 1992. Disability incidence rates declined rapidly between 1992 and 2000 and have slightly increased over recent years to reach levels that are generally lower than typical historical levels prior to the 1990s. Factors that have strongly influenced the decline are related to administrative changes put in place since 1994. The following factors contributed to the reduction in disability incidence rates:

- beginning in 1994, the CPP administration initiated a range of measures designed to effectively manage the growing pressure on the disability program;
- in September 1995, the guidelines for the determination of disabilities were revised to put the emphasis back on the medical basis and to de-emphasize the use of socio-economic factors. The guidelines are used at all levels in the determination process, thus greatly increasing consistency in decision-making;
- implementation of more stringent eligibility rules since 1998;
- increased reassessments of the disability status;
- expansion of vocational rehabilitation services; and
- implementation of a formal quality assurance program.

After considering the above factors, and the fact that the overall female incidence rate has been higher than for males since 1995, the aggregate (all ages combined using the 2003 population for weights) ultimate incidence rate for 2008 and thereafter is taken to be 3.25 per 1,000 for males and 3.50 per thousand for females. These aggregate ultimate incidence rates recognize recent experience and are somewhat higher than the 2003 averages of about 2.9 and 3.4 per 1,000 for males and females, respectively. It reflects recent increases observed over the last few years. The ultimate aggregate rates are then distributed by age in accordance with the average 2003 actual experience for each sex. For intervening years (2004 to 2008), male and female rates by age are assumed to increase gradually from their 2003 levels towards their assumed aggregate ultimate levels.

The ultimate incidence rates for this report are not directly comparable to the 18th CPP Actuarial Report assumptions. This is because of a change in the methodology used to derive the historical population eligible for disability benefits. The historical eligible population has been determined using actual CPP records of earnings information as opposed to being estimated and thus reflects more precisely the labour force attachment of CPP contributors. If this change in methodology had been possible under the 18th CPP Actuarial Report, the ultimate disability incidence rates of that report would have been about 3.5 and 3.8 per thousand for males and females, respectively.

Disability termination rates presented in Tables 57 and 58 are deemed to apply by age, sex and duration on an attained calendar year basis. The graduated average 1993 to 2002 experience is assumed to apply for 2004. For 2005 and subsequent calendar years, the 1993 to 2002 rates are projected by age at onset and duration since disablement based on 1993 to 2002 trends in recovery and mortality improvement rates. Projected disability incidence and termination rates are further adjusted to account for the disability reinstatement provision introduced by the amendments of Part 4 of Bill C-30.

Table 57 Disability Termination Rates in 2004
(per 1,000 people)

	Males						Females					
Age	1st Year	2nd Year	3rd Year	4th Year	5th Year	6+ Year	1st Year	2nd Year	3rd Year	4th Year	5th Year	6+ Year
30	75	80	61	59	46	29	68	67	58	52	35	22
40	77	59	47	39	33	21	61	60	35	27	23	14
50	115	85	53	37	32	24	78	75	38	28	21	14
60	114	74	47	43	33	0	79	65	40	28	24	0

Table 58 Disability Termination Rates in 2030
(per 1,000 people)

	Males						Females					
Age	1st Year	2nd Year	3rd Year	4th Year	5th Year	6+ Year	1st Year	2nd Year	3rd Year	4th Year	5th Year	6+ Year
30	67	73	57	54	43	26	62	63	54	51	33	20
40	69	54	43	35	31	19	55	56	33	26	22	13
50	106	79	50	35	30	21	71	72	36	28	20	13
60	105	69	44	40	30	0	72	63	38	26	22	0

Based on comparisons of actual results and projections for 1966 to 2003, experience adjustment factors were applied to all future emerging disability pensions calculated using the methodology described above. These factors appear in Table 59 below.

Table 59 Disability Benefit Experience Adjustment Factors

	Number	Average Benefit
Males	1.00	0.98
Females	1.00	0.92

Table 60 shows the projected number of new disability beneficiaries along with their projected average disability benefit by sex and year.

Table 60 New Disability Pensions

Year	Number of Beneficiaries			Average Monthly Pension			% of Maximum	
	Males	Females	Total	Males	Females	Total	Males	Females
				($)	($)	($)	(%)	(%)
2004	17,407	17,306	34,714	824.77	723.70	774.39	83.1	72.9
2005	18,453	18,068	36,521	838.02	738.50	788.78	82.9	73.0
2006	19,527	18,756	38,282	851.60	753.69	803.63	82.7	73.2
2007	20,445	19,319	39,764	864.95	769.21	818.44	82.4	73.3
2008	21,429	19,888	41,317	879.33	785.36	834.09	82.1	73.3
2009	21,974	20,314	42,287	895.62	802.75	851.01	81.9	73.4
2010	22,484	20,719	43,202	913.67	821.81	869.62	81.6	73.4
2015	24,535	22,382	46,917	1,032.22	942.23	989.29	80.2	73.2
2020	26,046	23,543	49,588	1,198.34	1,107.61	1,155.26	78.8	72.9
2025	26,097	23,739	49,836	1,401.29	1,311.88	1,358.70	77.7	72.8
2030	26,016	24,012	50,028	1,653.71	1,560.74	1,609.09	77.3	72.9
2040	28,143	25,825	53,968	2,322.80	2,203.96	2,265.93	76.9	72.9
2050	29,104	26,587	55,691	3,250.66	3,095.00	3,176.35	76.0	72.3

F. Survivor Expenditures

Starting in 1968, the number of male and female contributor deaths, taken from the demographic projections for each individual aged 18 and over, was multiplied by the survivor eligibility rates and the proportions of contributors married or in a common-law partnership at death to produce the number of survivor benefits emerging by age, sex and calendar year.

The assumed proportions of contributors married or in a common-law relationship at the time of death were determined from benefit statistics as at 31 December 2003. For each age and sex cell, the resulting actual proportions for years 2000 to 2002 were smoothed with slight adjustments. On the basis of the trends shown over the period 1990 to 2002, the proportions assumed for the projection period were extrapolated each year from 2001 to 2005. These proportions account for benefits extended, effective 1 January 2001, to same sex couples since 1998. The proportions are then assumed to remain constant after 2005. Values are shown in Table 61.

Table 61 Proportions of Contributors Married or in Common-Law Relationship at Death

Age	Males	Females
	(%)	(%)
20	1	2
30	30	37
40	54	68
50	67	70
60	73	62
70	74	49
80	67	25
90	47	5

For purposes of the survivor pensions, the number of spousal deaths, by sex and by calendar year, was categorized by age of the surviving spouses using the age distributions of spouses, and each resulting number was multiplied by:

- the initial benefit amount;
- the probability of the deceased spouse or common-law partner being eligible for a survivor benefit;
- the appropriate factor taking into account the reductions of survivor pensions in respect of survivors emerging under age 45 without dependent children and not disabled; and
- if applicable, the appropriate factor taking into account the limits applying to combined survivor-disability pensions and/or to combined survivor-retirement pensions.

The initial value of the earnings-related benefits is equal to 37.5% or 60% of the average retirement earnings-related benefit factor depending on whether the surviving spouse is under or over age 65. It is further adjusted upward to account for the fact that survivor eligibility rules are more stringent than for retirement benefits.

All survivor pensions emerging by year, as well as by age and sex of the surviving spouse, are then projected to each subsequent year by incorporating assumed mortality rates adjusted, using results of an actuarial study of the mortality of CPP survivors, to reflect the higher mortality of widows and widowers as compared to that of the general population, and making allowance for the Pension Index.

Based on comparisons of actual results and projections for 1966 to 2003, experience adjustment factors were applied to survivor pensions calculated using the methodology described above. Survivor experience adjustment factors reflect both methodology and assumption adjustments. The adjustment factors for the number of survivors are set at their current five-year average while the factors for the average earnings-related benefit correspond to the initial 2003 factor but trended for five years to year 2008. The adjustment factors appear in Table 62. Table 63 below shows the projected number and average monthly survivor pension by sex for selected years.

Table 62 Survivor Benefit Experience Adjustment Factors

	Initial		Ultimate	
	Number	Average Benefit	Number	Average Benefit
Widows	1.00	1.00	1.00	0.95
Widowers	0.93	0.84	0.93	0.78

Table 63 New Survivor Pensions

	Number of Beneficiaries			Average Monthly Pension	
Year	Under 65	65 and Over	Total	Under 65	65 and Over
				($)	($)
2004	23,128	37,004	60,131	340.52	272.39
2005	23,092	38,772	61,864	343.26	271.23
2006	23,174	39,806	62,979	345.92	270.56
2007	23,296	40,840	64,136	348.97	270.16
2008	23,490	41,890	65,380	352.08	269.47
2009	23,839	42,968	66,807	358.57	272.99
2010	24,001	44,031	68,032	365.63	277.00
2015	25,023	49,999	75,023	412.55	301.55
2020	25,829	57,586	83,415	477.55	340.95
2025	26,426	67,366	93,792	556.06	396.96
2030	26,577	78,848	105,425	649.37	471.04
2040	26,115	97,033	123,148	901.14	668.46
2050	26,052	102,381	128,433	1262.54	941.76

G. Death Expenditures

The amount of lump sum death benefits payable each year starting in 1968 was determined by age and sex as the product of:

- the number of deaths, derived by sex for individuals age 18 and over, consistent with the population data and projections;
- 50% of the average annual retirement earnings-related benefit factor (the lump sum death benefit is equivalent to six months of retirement pension) reduced, using the maximum retirement pension and the assumed distribution of average retirement pensions, to allow for the provision limiting the death benefit to 10% of the YMPE for the year of death prior to 1998 and to $2,500 thereafter; and
- the proportion of the deceased contributor's earnings eligible for survivor benefits.

Based on the comparison of actual results and projections for 1966 to 2003, experience adjustment factors were derived. To account for the maximum death benefit, which is set at $2,500 for 1998 and thereafter, adjustment factors for average benefits are set at their current level but are gradually increased to unity for years 2020 and 2030 and thereafter for males and females, respectively. Tables 64 and 65 below show the experience adjustment factors and the projected number of death benefits by sex for selected years.

Table 64 Death Benefit Experience Adjustment Factors

	Initial		Ultimate	
	Number	Average Benefit	Number	Average Benefit
Males	1.00	0.94	1.00	1.00
Females	0.98	0.92	0.98	1.00

Table 65 Number of Death Benefits

Year	Males	Females	Total
2004	74,659	38,590	113,249
2005	76,249	40,415	116,664
2006	77,766	42,305	120,071
2007	79,347	44,182	123,529
2008	81,031	46,101	127,132
2008	82,861	48,074	130,935
2010	84,599	50,002	134,601
2015	94,094	59,893	153,987
2020	104,973	70,237	175,210
2025	118,493	82,133	200,626
2030	134,685	96,342	231,027
2040	165,260	127,621	292,881
2050	180,465	148,392	328,856

H. Children's Expenditures

The numbers of disabled contributor's child and orphan benefits emerging each year starting in 1970 and 1968, respectively, were determined using the assumed fertility rates, to correspond to the number of children of emerging beneficiaries of disability and/or survivor pensions. The resulting number of emerging children by age, sex and calendar year were thereafter projected from one year to the next, incorporating the following reasons for termination of benefits:

- attainment of age 25 by the child;
- ceasing full-time attendance at school while over age 18; and
- regarding disabled contributor's child benefits only, termination (recovery, death or attainment of age 65) of the parent's disability benefits.

Total eligible child benefits were then obtained for any given calendar year as the product of (1) the aggregate number of child beneficiaries who emerged before and during the year and survived to the applicable year and (2) the applicable annualized amount of the child flat-rate benefit obtained by adjusting the 2004 rate in accordance with the Pension Index. Based on historical data for 1966 to 2003, the assumption on the number of children under age 18 is adjusted by a factor of about 0.8 for both disabled contributors' children and orphans. The assumption on the number of children aged 18 and over attending school is adjusted by a factor of about 0.7 for both disabled contributors' children and orphans. Table 66 shows the projected number of new eligible-child benefits by type and year.

Table 66 New Children Benefits

Year	Disabled Contributor's Child	Orphans	Total
2004	17,613	11,554	29,167
2005	18,324	11,507	29,830
2006	18,993	11,421	30,414
2007	19,580	11,307	30,887
2008	20,169	11,202	31,371
2009	20,427	11,154	31,581
2010	20,661	11,078	31,739
2015	21,743	10,669	32,412
2020	22,945	10,509	33,454
2025	24,225	10,677	34,902
2030	25,718	10,993	36,711
2040	27,538	11,087	38,625
2050	27,844	10,526	38,370

I. Administrative Expenses

The administrative expenses of the CPP have historically arisen from different sources including SDC, Canada Revenue Agency, Public Works and Government Services Canada, Office of the Superintendent of Financial Institutions and the Department of Finance. The investment expenses and administrative expenses of the CPP Investment Board are treated separately (see section VI). In calendar year 2003, administrative expenses excluding the CPP Investment Board amounted to about $474 million.

Based on recent experience, the annual administrative expenses were on average about 0.091% of total annual employment earnings during the period from 1999 to 2003. The projected CPP administrative expenses in terms of total annual employment earnings are projected to be 0.093% for 2004 and thereafter.

VI. Assets

The total assets of the CPP at the end of any given year throughout the projection period are simply determined by adding together the total assets at the end of the previous year, projected investment earnings and contribution revenues and then subtracting the projected benefits and administrative expenses of the given year.

The actual value of assets (on a market value basis) as at 31 December 2003 was $67.6 billion. This is the sum of the assets in the three funding vehicles of the CPP: the CPP Account (Operating Balance), the CPP Fund and the assets under CPP Investment Board management. The CPP Account consists of short-term investments deemed to be approximately three months' worth of benefit expenditures. The CPP Fund consists of provincial bonds pursuant to loans made to provinces. It is assumed that the assets of the CPP Investment Board will consist of fixed income securities such as bonds and of variable income securities such as Canadian, U.S. and foreign equities, as well as real return assets such as real estate and infrastructure. Table 67 reconciles the assets as at 31 December 2003 from a cash basis to a market value basis.

Table 67 Assets as at 31 December 2003
($ million)

Assets cash value as at 31 December 2003	**60,452**
Plus: Receivables	
Contributions	1,314
Accrued interest on the Fund	663
Accumulated net income from CPP Investment Board	1,584
Benefits	50
Amount due from QPP	42
Minus: Liabilities	
Accounts payable	77
Assets cost accrual value as at 31 December 2003	**64,028**
Increase in CPP Fund due to market valuation	3,586
Assets market value as at 31 December 2003	**67,614**

Appendix C – Sensitivity Tests

This actuarial report on the Canada Pension Plan is based on the projection of its revenues and expenditures over a long period of time. The information required by statute, which is presented in Section IV of this report, has been derived using best-estimate assumptions regarding future demographic and economic trends. The key best-estimate assumptions, i.e. those for which changes within a reasonable range have the most significant impact on the long-term financial results, are described in Section III of this report.

Both the length of the projection period and the number of assumptions required ensure that actual future experience will not develop precisely in accordance with the best-estimate assumptions. Sensitivity tests have been performed, consisting of projections of CPP financial results using alternative assumptions.

The sensitivity tests were performed by varying each of the nine key assumptions individually with the remaining assumptions being maintained at their best-estimate levels. Two tests were performed with respect to each of the assumptions. The alternative assumptions selected are intended to represent a wide range of potential long-term experience. However, the results cannot simply be combined because a change in any particular assumption may have an impact on another to various degrees. The younger and older population scenarios shown in Section V of this report present a more realistic picture of the possible range for the future financial status of the Plan than does combining the individual tests presented in this Appendix. Each of these sensitivity tests was categorized as either a low-cost scenario or a high-cost scenario. In the low-cost scenarios, the alternative assumptions have the effect of reducing the steady-state contribution rate. Conversely, in the high-cost scenarios, the assumptions would increase the steady-state contribution rate.

The individual sensitivity tests presented in this Appendix are based on a deterministic approach (i.e. developed assuming a specific range of values for each assumption) and provide only for a wide range of possible outcomes for each assumption. Not all tests provide an indication of the probability that the actual level of the assumption will be inside or outside the assumed range of values for each assumption. Based on historical data and using stochastic modeling techniques, the probability that the actual value for the assumption will fall outside the specified range of potential outcomes for the following tests: migration, real wage, inflation and real rates of return on investments assumptions has been estimated.

Over the long term, economic cycles have little impact on pay-as-you-go contribution rates as long as, on average, the ultimate assumptions are realized. Their impact on the steady-state contribution rate depends primarily on the assumed pattern of rates of return on investments and real wages. Nevertheless, a separate test dealing with economic cycles is presented in addition to all individual tests. For this purpose, a short-term economic slowdown cycle has been prepared to show the impact it would have on the long-term pay-as-you-go-rates and on the steady-state contribution rate. This test is described in more detail in section X of this Appendix after a brief presentation of the results in section XI, section XII discusses the concept of financial markets volatility and how this may affect the future costs of the Plan under various scenarios.

Table 68 below summarises the alternative assumptions used in the sensitivity tests. It is followed by a brief discussion of each assumption and the impact its variation has on the results.

Table 68 Sensitivity Test Assumptions

	Canada	Low-Cost	Best-Estimate	High-Cost
I.	Fertility rate	1.90	1.60	1.30
II.	Net migration rate	0.64%	0.54%	0.44%
III.	Mortality rates	Life expectancy at 65 (2050) Males 18.7 Females 21.4	Life expectancy at 65 (2050) Males 20.0 Females 22.6	Life expectancy at 65 (2050) Males 21.2 Females 23.8
IV.	CPP disability rates (per 1,000 eligible)	Males 2.25 Females 2.50	Males 3.25 Females 3.50	Males 4.25 Females 4.50
V.	Retirement rates	All retirements at age 65 from 2009 onward	Retirements between ages 60 to 70	All retirements at age 60 from 2009 onward
VI.	Unemployment rate	4.5%	6.5%	8.5%
	Participation rates (ages 15-69)	81% (2030)	73% (2030)	71% (2030)
VII.	Real-wage differential	2.0%	1.2%	0.5%
VIII.	Rate of increase in prices	3.7%	2.7%	1.7%
IX.	Real rate of return on investments	5.1%	4.1%	3.1%

I. Fertility Rate

The best-estimate assumption is that the total fertility rate for Canada will increase slightly from its 2001 level of 1.51 to an ultimate level of 1.60 in 2016. This lies between the medium and high assumptions adopted by Statistics Canada for its most recent population projections.

The low-cost assumption has the fertility rate increasing to an ultimate level of 1.90 in 2016. This is consistent with Statistics Canada's high assumption and represents a return to the levels typical of the early 1970s. Under this scenario, the population grows to a level in 2050 that is 10.5% higher than under the best-estimate assumption.

The high-cost assumption has the fertility rate decreasing to an ultimate level of 1.30 in 2016. This is consistent with Statistics Canada's low assumption and represents a continuation of the historical trend of decreases. Under this scenario, the population grows much more slowly, to a level in 2050 that is 9.7% lower than under the best-estimate assumption.

Changes in the fertility rate have a small short-term impact on the CPP's financial position. However, the long-term impact of changes may be significant.

II. Net Migration Rate

An ultimate best-estimate assumption of 0.54% of the population has been established for 2020 and thereafter. This level is reached in two steps; first a level of 0.50% is kept constant from 2004 until 2015, then the ultimate level of 0.54% is gradually reached in 2020. This is consistent with experience over the last 15 to 25 years and with the ultimate migration level between the medium and high Statistics Canada population projections.

The low-cost assumption has net migration increasing to an ultimate level of 0.64% of the population in 2020. This is consistent with Statistics Canada's high assumption. Under this scenario, the population grows to a level in 2050 that is 4.5% higher than under the best-estimate assumption.

The high-cost assumption has net migration decreasing to an ultimate level of 0.44% of the population in 2020. This is consistent with Statistics Canada's low assumption. Under this scenario, the population grows much more slowly, to a level in 2050 that is 4.3% lower than under the best-estimate assumption.

Based on the net migration rate experience of the last 32 years (1972 to 2003), a stochastic approach was used to randomly generate the geometric mean of the net migration rate over a 20-year period. The results show that the probability of the net migration rate over the next twenty years exceeding 0.64% is 0%, while the probability of it being below 0.44% is 5%.

III. Mortality Rates

Mortality improvements are expected to continue in the future. The best-estimate ultimate rates of improvement were established by adjusting the results of a detailed study prepared by the Office of the Chief Actuary of United States Social Security Administration regarding trends in mortality by age, sex and cause of death to reflect, in part, historical differences in mortality improvements between Canada and the United States. Rates of improvement are kept at their current levels for the first five years of projections and are then graded down to ultimate values by 2025.

For the low-cost scenario, mortality is assumed to improve less rapidly. Rates of improvement were assumed to grade down from recent levels to zero by 2025. Under this scenario, the population grows to a level in 2050 that is 1.7% lower than under the best-estimate assumption.

For the high-cost scenario, mortality is assumed to improve more rapidly. Rates of improvement were assumed to grade down from recent levels to 200% of the best-estimate ultimate levels by 2025. Under this scenario, the population grows to a level in 2050 that is 1.7% higher than under the best-estimate assumption.

The different rates of improvement would result in the following life expectancies:

Table 69 Life Expectancy in 2050 Under Alternative Assumptions
(Canada)

		Low-Cost	Best-Estimate	High-Cost
At Birth	Males	80.1	82.0	83.9
	Females	83.6	85.3	86.9
At Age 65	Males	18.7	20.0	21.2
	Females	21.4	22.6	23.8

The life expectancies shown in Table 69 were calculated as if the mortality rates assumed for year 2050 were applicable in all subsequent years.

IV. Disability Rates

The best-estimate projections assume that disability incidence rates will remain at approximately their current levels. The assumed rates vary by age and sex. Based on the current distribution of the population, the resulting aggregate ultimate rate of incidence for years 2008 and later is 3.25 new disabilities per year among 1,000 eligible workers for males and 3.50 per thousand for females, on average.

For the low-cost scenario, disability incidence rates are assumed to continue their recent trend of improvement, reaching ultimate levels in 2008 of 2.25 per thousand for males and 2.50 per thousand for females. Such incidence rates would be slightly lower than those experienced under the CPP in the late 1990s.

For the high-cost scenario, disability incidence rates are assumed to return to levels similar to those of the early 1990s. Ultimate incidence rates, reached in 2008, would be 4.25 per thousand for males and 4.50 per thousand for females.

Disability continuance rates assumed for future years, under all scenarios, have been based on the average experience during the period 1993 to 2002.

V. Retirement Rates

Retirement rates are used to determine the distribution of retirement ages of new retirement beneficiaries. The best-estimate scenario uses the 1999 to 2003 average as the starting point in 2004; that average is modified over the next 30 years to take into account the labour shortage and increases in participation rates at ages 60 to 64.

For the low-cost scenario, retirement rates were modified over the next five years so that all retirements were assumed to occur at age 65 beginning in 2009. The proportion of persons with earnings at ages 60 to 64 was therefore increased.

For the high-cost scenario, retirement rates were modified over the next five years so that all retirements were assumed to occur at age 60 except for about 10% to account for disabled beneficiaries converting to retirement at age 65. The proportion of persons with earnings was accordingly set to zero at ages 60 and over.

VI. Unemployment Rate - Participation Rates

Employment levels are reflected in the actuarial projection model through the assumption made regarding the level of the labour force and job creation rates, by year, age and sex. These rates vary not only with the rate of unemployment, but also reflect trends in increased workforce participation by women, longer periods of formal education among young adults and the trends in retirement patterns of older workers. The ultimate level of unemployment assumed to apply in 2020 and thereafter is 6.5%.

For the low-cost scenario, the job creation rates are assumed to increase more rapidly, which results in an ultimate level of unemployment rate of 4.5% in 2020. For the high-cost scenario, the job creation rates are assumed to increase more slowly, which results in an ultimate level of unemployment rate of 8.5% in 2020.

Participation rates are used to estimate the active population. The best-estimate scenario divides the projection period into three periods, i.e. 2004 to 2010, 2010 to 2020 and 2020 to 2030. During the first period, the labour force participation rate for ages 15 to 69 decreases slightly from about 75% in 2003 to 74% in 2010. For 2010 to 2020, the participation rates continue to increase to compensate for the labour shortage, particularly at ages below 55. For 2020 to 2030, the baby boomers will have reached normal retirement age; combined with the projected low growth in the population, this leads to downward pressure on the ratio of active to working-age persons. For this reason, the participation rates of those aged 55 and over, especially those aged 60 to 64, are increased to partially offset the decrease in the overall participation rate. This results in a slight increase in the active population over that period.

For the low-cost scenario, male participation rates are assumed to reach their highest historical level by 2030 and females are assumed over the same period to reach the level of males. This results in an overall participation rate of 81% for those aged 15 to 69 in 2030.

For the high-cost scenario, male and female participation rates are assumed to remain constant at their 2003 levels. This results in an overall participation rate of 71% for those aged 15 to 69 in 2030.

VII. Real-Wage Differential

Wage increases affect the financial balance of the CPP in two ways. In the short-term, an increase in the average wage translates into higher contribution income, with little immediate impact on benefits. Over the longer term, higher average wages produce higher benefits. The long-term projected financial position of the CPP is more dependent on the differential between the assumed annual rates of wage increase and price increase (the real-wage differential) than on the absolute level of wage increases assumed.

An ultimate real-wage differential of 1.2% has been assumed in years 2012 and thereafter for the best-estimate projections. Combined with the best-estimate price increase assumption of 2.7%, it results in assumed nominal annual increases in wages of 3.9% in 2015 and thereafter. During the initial years of the projection period, the real-wage differential is assumed to increase gradually from 2004 to its ultimate level.

For the low-cost scenario, the assumed real-wage differential increases to an ultimate level of 2.0% in 2012. This corresponds to the highest real-wage differential ascertained from a series of economic forecasts and is much higher than recent experience.

For the high-cost scenario, the assumed real-wage differential increases to an ultimate level of 0.5% in 2006. While much lower than long-term historical averages, it nevertheless represents an improvement from shorter-term historical averages.

Based on the real wage increase experience of the last 80 years (1924 to 2003), a stochastic approach was used to randomly generate the geometric mean of the real wage increase over a 20-year period. The results show that the probability of the real wage increase over the next twenty years exceeding 2.0% is 12%, while the probability of it being below 0.5% is 4%.

VIII. Price Increases

An ultimate annual rate of price increase of 2.7% has been assumed for the best-estimate projections. The rate of price increase is assumed at 2.0% from 2004 to 2008 and is then assumed to increase uniformly to its ultimate level of 2.7% in 2015.

For the low-cost scenario, the annual rate of price increase is assumed to rise to an ultimate level of 3.7% in 2015. This level of inflation is comparable to long-term historical averages. Although a higher rate of increase in prices results in higher CPP expenditures, it also results in higher contributory earnings (this is because the same real-wage differential is added to a higher base of inflation, producing a higher nominal rate of wage increase).

For the high-cost scenario, the annual rate of price increase is assumed to be 1.7% for years 2004 and thereafter. This level of inflation is comparable to that of the 1960s and 1990s.

Based on the price increase experience of the last 80 years (1924 to 2003), a stochastic approach was used to randomly generate the geometric mean of the price increase over a 20-year period. The results show that the probability of the price increase over the next twenty years exceeding 3.7% is 26%, while the probability of it being below 1.7% is 6%.

IX. Rate of Return on Investments

In accordance with the new policy of investing the assets in a diversified portfolio, the ultimate real rate of return on investments is projected to be 4.1% under the best-estimate assumptions.

For the low-cost scenario, the real rate of return on investments is assumed to be 5.1%. For the high-cost scenario, the real rate of return on investments is assumed to be 3.1%. The real rates of return have no effect on the pay-as-you-go rates, since they affect neither benefits nor contributory earnings.

Based on the real rate of return experience of the last 65 years (1939 to 2003), a stochastic approach was used to randomly generate the geometric mean of the real rate of return over a 20-year period. The results show that the probability of the real rate of return over the next twenty years exceeding 5.1% is 59%, while the probability of it being below 3.1% is 15%.

X. Economy

Under the best-estimate scenario, a moderate but sustainable growth in the economy is assumed to persist throughout the projection period. The sensitivity test presented in this section assumes an economic slowdown followed by a partial economic recovery.

Under this scenario, the total contributory earnings are reduced by 6% in 2006 and followed by a partial recovery thereafter. The unemployment rate is increased in 2006 and gradually reverts to its best-estimate value over the following ten years. The real increases in average weekly earnings and average annual earnings are reduced for 2006.

XI. Results

Under each scenario, contribution rates were projected to follow the current schedule through 2006 and a new steady-state contribution rate was determined for years 2007 and thereafter. Table 70 summarizes the pay-as-you-go contribution rates and the steady-state contribution rates under each of the scenarios.

Under some of the sensitivity tests, the ultimate pay-as-you-go rates do not stabilize. In such cases, while the steady-state contribution rates shown in Table 70 would be adequate through 2075, they could result in significant increases or decreases in the ratio of assets to expenditures in the later years of the projection period.

Table 71 summarizes the projected impact on the ratio of the assets to the following year's expenditures under each of the alternative sets of assumptions, if the currently scheduled contribution rate of 9.9% continues to apply in years 2007 and thereafter.

Table 70 Sensitivity of Steady-State Contribution Rate
(percentages)

			Steady-State Contribution Rate	Pay-as-You-Go Rates		
	Assumption	**Scenario**		**2025**	**2050**	**2075**
		Best-Estimate	9.8	10.42	11.29	11.32
I.	Fertility Rate	Low	9.5	10.38	10.44	9.83
		High	10.1	10.47	12.30	13.28
II.	Migration Rate	Low	9.6	10.13	10.91	10.92
		High	9.9	10.62	11.71	11.74
III.	Mortality Rates	Low	9.6	10.39	10.97	10.68
		High	9.9	10.46	11.60	11.92
IV.	Disability Rates	Low	9.5	10.14	11.01	11.05
		High	10.0	10.70	11.58	11.59
V.	Retirement Rates	Low	9.4	9.65	11.12	11.22
		High	10.2	11.33	11.49	11.40
VI.	Unemployment and Participation Rates	Low	9.3	9.57	10.73	11.28
		High	10.0	10.88	11.47	11.29
VII.	Real-Wage Differential	Low	9.2	9.52	9.96	9.96
		High	10.3	11.33	12.68	12.77
VIII.	Price Increases	Low	9.6	10.12	11.00	11.08
		High	10.0	10.70	11.66	11.61
IX.	Real Rate of Return on Investments	Low	9.3	10.42	11.29	11.32
		High	10.3	10.42	11.29	11.32
X.	Economic Cycle		9.9	10.52	11.26	11.32

Table 71 Sensitivity of Funding Levels
(9.9% ultimate contribution rate)

	Assumption	Scenario	Asset/Expenditure Ratio		
			2025	2050	2075
		Best-Estimate	5.75	6.28	6.88
I.	Fertility Rate	Low	5.75	7.32	11.82
		High	5.75	5.23	1.57
II.	Migration Rate	Low	6.09	7.56	9.85
		High	5.57	5.31	4.32
III.	Mortality Rates	Low	5.79	7.00	9.87
		High	5.71	5.61	4.34
IV.	Disability Rates	Low	6.36	8.04	10.78
		High	5.17	4.59	3.15
V.	Retirement Rates	Low	7.61	9.55	13.02
		High	3.79	2.48	*
VI.	Unemployment and Participation Rates	Low	6.89	9.94	13.54
		High	5.12	4.46	3.53
VII.	Real-Wage Differential	Low	6.48	9.42	13.68
		High	5.08	2.98	**
VIII.	Price Increases	Low	5.97	7.42	9.58
		High	5.44	4.87	3.53
IX.	Real Rate of Return on Investments	Low	6.87	10.70	19.40
		High	4.81	3.41	0.92
X.	Economic Cycle		5.05	5.14	4.83

* Assets depleted by 2074.
** Assets depleted by 2067.

XII. Financial Markets Volatility

A. Background

In 1996, a review was commissioned by the federal and provincial finance ministers to determine the best ways to ensure the long-term financial sustainability of the Plan.

As a result of the review, the CPP Investment Board was created in 1997 with the object "to invest its assets with a view of achieving a maximum rate of return, without undue risk of loss, having regard to the factors that may affect the funding of the Canada Pension Plan and the ability of the Canada Pension Plan to meet its financial obligations on any given business day." It was acknowledged that to ensure the sustainability of the Plan, higher rates of return would be required on the assets, and that continuing to invest solely in short-term and fixed income instruments would ultimately require a higher contribution rate and thus was not a viable option. Hence, the CPP Investment Board was created to diversify the assets of the Plan by investing in equities as well as other asset classes with the aim of achieving higher returns. The role of the CPP Investment Board will become increasingly important as assets are expected to grow rapidly over the next 17 years with contributions to the Plan projected to exceed expenditures over this period. After 2021, it is projected that investment earnings will be required to meet expenditures.

Historically, equities have shown greater volatility than fixed income instruments (bonds), where volatility is a measure of the magnitude of fluctuation in returns. For instance, in the fifty, twenty-five, and ten years ending 2003, the volatility (standard deviation) of Canadian equities (indicated now by the S&P/TSX Total Return Index) has been 16.6%, 16.8%, and 16.3%, respectively, as given in the Canadian Institute of Actuaries' *Report on Canadian Economic Statistics 1924 – 2003* (CIA Report). This compares with a volatility of long-term federal bonds of 10.4%, 12.0%, and 11.1% over the same time periods. Higher volatility of a security's returns implies a greater risk since the range of possible outcomes of returns increases. Hence, equities are viewed as being riskier than bonds. This higher volatility has resulted in equities historically producing higher returns than bonds over a long term.

Investors requiring higher returns from their portfolios may seek to invest in equities; however, by doing so, a higher level of risk is undertaken. This describes the key risk-reward relationship, whereby investors seek a higher level of return over the long term, or an equity risk premium, in exchange for undertaking a higher level of risk. Nevertheless, over the short term, the potential for higher returns exists along with that for lower returns due to the higher level of volatility. Over the last fifty, twenty-five, and ten years ending 2003, the average nominal return of Canadian equities has been 10.4%, 10.8%, and 8.6%, respectively, and for long-term federal bonds, the average nominal return has been 7.2%, 10.9%, and 8.5%, respectively, as given in the CIA Report. Although the average return of equities has been higher than federal bonds over the last fifty years, it has provided similar returns over the last twenty-five years.

Investing in a greater percentage of equities necessarily requires assuming a higher level of risk and hence a possibility of realizing a wider range of returns. Conversely, investing in lower risk fixed income instruments will tend to yield lower returns. Further, by accepting lower returns with lower risk, investment objectives may not be achieved. If CPP assets were invested solely in long-term federal bonds starting in 2010, a lower return would be realized. Under such a scenario, the lack of equity investments would cause the steady-state contribution rate to increase to 10.5%. As such, investment in equities, and thus incurrence of higher risk, is necessary for the CPP in order to maintain the steady-state contribution rate below the legislated rate.

The following two sections discuss the impact of financial markets volatility on the steady-state contribution rate by considering alternative scenarios where equity returns other than the best-estimate are assumed to occur over two different two-year periods.

B. Measuring the Impact of Financial Markets Volatility (2017 to 2018)

Under the best-estimate assumptions of this report, it is expected that the Plan will be about 25% funded by 2025. As an illustration of the possible impact of volatility in equity returns, different rates of return for Canadian and foreign equities are assumed to occur in 2017 and 2018 under various asset portfolios of the CPP.

Two alternative portfolios have been assumed to illustrate the potential impact of a riskier (Portfolio I, 70% equities) and less risky (Portfolio II, 30% equities) portfolio in relation to the best-estimate portfolio. The resulting steady-state contribution rates are given in Table 72. In addition, the probabilities of realizing such returns are given for the best-estimate portfolio. For a return of 0% in 2017 and 2018, the probability is of achieving 0% or less on average over a two-year period. All probabilities are based on historical equity returns over the last 65 years ending 2003.

Following the various equity returns in 2017 and 2018, it is assumed that the returns revert back to their best-estimate values from 2019 onward. For each portfolio, the proportion allocated to foreign equities is 30%.

The probabilities in Table 72 indicate that there is a greater likelihood of realizing an average positive return over two consecutive years; however, the likelihood of realizing no or negative returns still amounts to about 20%.

Table 72 Steady-State Rate Under Various Equity Returns and Portfolios (2017 and 2018)

Annual Nominal Equity Returns in 2017 and 2018	Best-Estimate Portfolio: Steady-State Rate	Best-Estimate Portfolio: Probability of Return(*)	Portfolio I: 70% Equities/ 30% Fixed Income: Steady-State Rate	Portfolio II: 30% Equities/ 70% Fixed Income: Steady-State Rate
(%)	(%)	(%)	(%)	(%)
+20	9.6	23	9.5	9.8
+15	9.7	37	9.5	9.8
+10	9.7	52	9.6	9.9
+7.5	***9.8***	***56***	***9.7***	***9.9***
0	9.9	20	9.8	10.0
-10	10.0	5	10.0	10.0
-15	10.1	2	10.1	10.1

(*) The probability of equity returns over two consecutive years being -10% is the probability that the average return is -10% or less over the two-year period. Similarly, the probability of equity returns being +10% over two consecutive years is the probability that the average return is +10% or more. For a return of 0%, the probability corresponds to the average return being 0% or less over the period.

Portfolio I has the greatest proportion of Canadian and foreign equity. As a result, the steady-state contribution rate changes the most from its initial value. For instance, with an average return of -15% over two years, the steady-state contribution rate under Portfolio I increases by 0.4% (10.1% - 9.7%). This compares with increases of 0.3% for the best-estimate portfolio and 0.2% for Portfolio II. Similarly, for average positive returns over two years, the steady-state contribution rate decreases to a larger extent under Portfolio I compared to the other two portfolios. In comparison, Portfolio II has the greatest fixed income content, which results in the steady-state contribution rate changing the least from its initial value compared to the other two portfolios. Positive returns both provide additional room to absorb some of the impact of future adverse experience and cause the steady-state contribution rate to decrease. Conversely, negative returns remove room to offset adverse experience and cause the steady-state contribution rate to increase.

C. Measuring the Impact of Financial Markets Volatility (2005 to 2006)

It is interesting to consider a scenario where significant changes in equity returns over two consecutive years occur in 2005 and 2006, instead of 2017 and 2018. Table 73 shows the results for this scenario. Only the best-estimate portfolio is considered, since it would be difficult to implement a different asset mix in the very near term.

In the cases where an average return of plus or minus 15% occurs in 2005 and 2006, the steady-state contribution rate increases from 9.7% to 9.9%, or 0.2%, as shown in Table 73. If the same returns are experienced in 2017 and 2018, the corresponding increase is from 9.7% to 10.1%, or 0.4%, as shown in Table 72. The magnitude of the change in the steady-state contribution rate is smaller in 2005 and 2006 compared to 2017 and 2018 because of how the steady-state contribution rate is determined and when the returns occur.

Table 73 Steady-State Rate Under Various Equity Returns (2005 to 2006)

Annual Nominal Equity Returns 2005-2006	Steady-State Rate
(%)	(%)
+20	9.7
+15	9.7
+10	9.7
0	9.8
-10	9.9
-15	9.9

If a return of -15% occurs in 2017 and 2018, then the assets will experience a greater dollar loss compared to that which would occur in 2005 and 2006, since the assets and the funding level will have grown to a higher value by 2017. This greater absolute loss would result in a higher steady-state contribution rate.

Appendix D – Financing the Canada Pension Plan

I. Long-Term Financial Status and Funding of the Canada Pension Plan

Historically, the retirement system in Canada has been designed as a three-tier system. Firstly, the Old Age Security (OAS) Program provides for a minimum floor based on residence in Canada. Secondly, the CPP covers most employment earnings. Finally, individuals may be covered by registered private pension plans (RPP) and can purchase individual registered retirement savings plans (RRSP) to complete their retirement needs.

Each tier is financed using a different approach; OAS is financed through general tax revenues on a pay-as-you-go basis, the CPP is partially funded (projected 25%) based on contributions on employment earnings and RPPs and RRSPs are fully funded. To properly assess the long-term financial status of the CPP, one must consider the whole retirement pension system in Canada rather than the CPP in isolation. This variety in funding methods enables the system to be steered towards more or less funding by putting emphasis on the different tiers depending on the demographic and economic conditions.

Historically, the objective of CPP funding has been to accumulate and maintain a small reserve worth about two years of benefits. However, because of changes in the demographic and economic conditions (low fertility rates, real interest rates greater than real earnings growth), more funding for the CPP became desirable. In reaction to this, amendments were made in 1998 to gradually increase the level of CPP funding by increasing contribution rates over the short term, reducing benefits over the long term and investing cash flows in the private markets through the CPP Investment Board to achieve higher rates of return. It is projected that the level of funding for the CPP will grow from its current level of about 12% to a level of about 25% over the next few decades. The objective of the changes was to improve the financial long-term sustainability of the Plan. This will be accomplished if the degree of funding and the contribution rate remain relatively stable, which implies a long-term growth rate of assets at least equal to the long-term growth rate of liabilities.

There exist various ways to fully assess the long-term financial status of the CPP. The first measure of long-term sustainability uses the accrued benefit actuarial valuation method and the second is a measure called the "actuarial balance". These two measures address the adequacy of financing the projected costs over the long-range period as a whole, and the likely stability of the long-term financial status for future CPP reports. These measures are discussed in more detail in the following sections.

II. Actuarial Valuation – Accrued Benefit Method

The Canada Pension Plan is a defined benefit pension plan, i.e. in exchange for contributions, a worker and his or her dependants become eligible for a range of benefits, the amounts of which are based on his or her participation and earnings history. In this sense, the CPP is similar to a defined benefit pension plan that might be established by an employer for its employees.

However, the CPP differs from a typical employer sponsored pension plan in that it is only partially funded. CPP assets are expected to reach a level of about six years of expenditures over the next 30 years, which represents about a 25% funding level under the assumptions of this report. From its inception, the CPP was never intended to be a fully funded plan, as it is only one of the three components of the retirement pension scheme in Canada. As mentioned earlier, the three pillars of the retirement system are complementary as their funding approaches differ, provide better flexibility and shorten the time required to adjust to changing demographic and economic circumstances. These changing conditions might make it more or less costly to prefund retirement liabilities.

The accrued benefit method is used to determine the actuarial liability of the CPP. It is the method most widely used for the actuarial valuation of registered pension plans. Under this method, the benefits that will be paid in respect of CPP participation on or before the valuation date must first be projected. This projection is based on the best-estimate assumptions described in Appendix B, with the following exceptions:

- no new entrants to the workforce are included; and
- current Plan participants who are not yet retired at the valuation date are assumed to have no contributory earnings beyond that date.

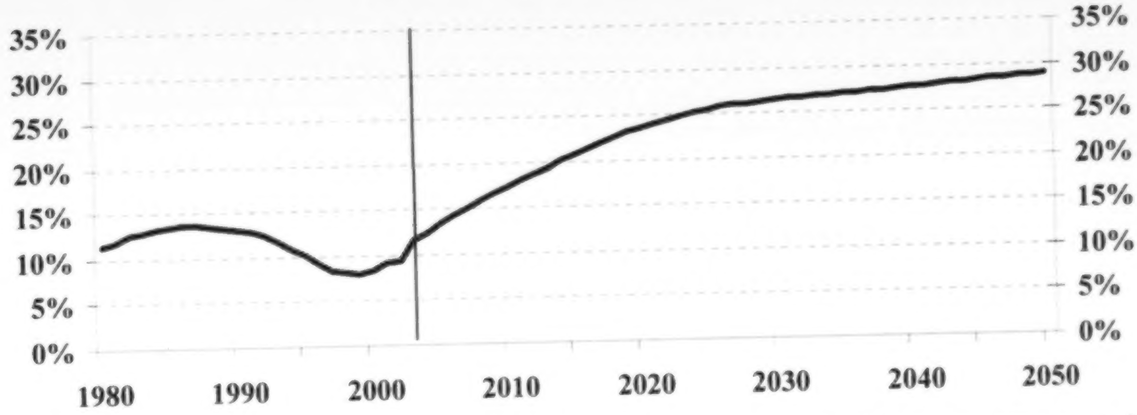
Next, the projected expenditures were discounted at interest to determine their present value, which is the actuarial liability. The actuarial position as at 31 December 2003 is presented in Table 74. To obtain the unfunded liability, CPP assets are deducted from the actuarial liability at the valuation date.

Table 74 Balance Sheet as at 31 December 2003

	Amount	% of Liability
	($ billion)	
Actuarial liability	583.9	100
Market value of assets	67.6	12
Unfunded liability	516.3	88

If the CPP were fully funded, the asset/expenditure ratio would be about 24.4 instead of 2.8 as at 31 December 2003. This ratio will vary in future years, in accordance with demographic and economic experience and any changes in assumptions. With the changes introduced in 1998, the CPP has been moving away from pay-as-you-go financing (with a small contingency reserve) towards fuller funding. Therefore, the funding of the Plan is expected to increase from its current level of 12% to a level of about 25% by 2025, thus reducing the relative size of the unfunded liability. The unfunded liability is put in a better perspective by looking at the future funding level of the CPP. Chart 16 summarizes this information.

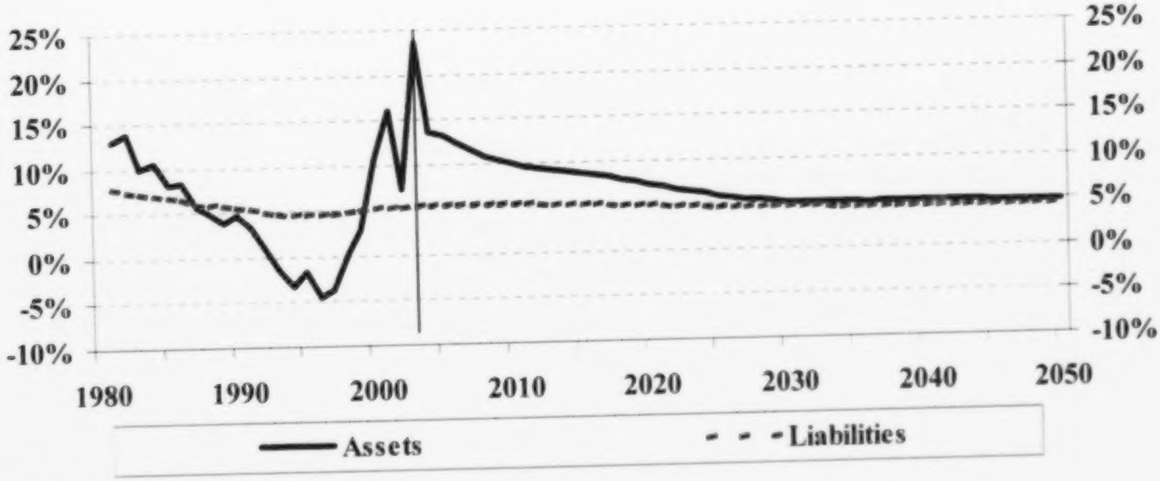
Chart 16 Funding Ratio
(9.9% contribution rate for 2007+)



The normal actuarial cost represents the value of future benefits earned in a year. The normal cost for 2004 was calculated as $15.8 billion or 5.5% of projected 2004 contributory earnings. Other things being equal, the normal cost is expected to grow to 5.6% by 2030 as the average age of CPP participants is expected to increase over that period. For 2030 and thereafter, the normal cost is expected to remain relatively stable at that level until the end of the projection period. The difference between the legislated contribution rate of 9.9% and the normal cost is used to significantly increase the funding level of the Plan from 12% in 2003 to about 25% by 2025. Again, these results confirm that the current financial status of the Plan is projected to improve significantly over the next 50 years.

One way to understand the effect of the 1998 amendments on the CPP financial status is to look at the past and projected evolution of assets and liabilities using the best-estimate assumptions presented in this report. The historical and projected annual growth rates of assets and liabilities are presented in Chart 17.

Chart 17 Annual Growth Rates of Assets and Liabilities



As can be seen in Chart 17, up to 1985 the CPP was accumulating assets more rapidly than its liabilities were growing, resulting in an asset worth about six times annual benefits by the end of 1985. However, from 1985 until the last part of the 1990s assets started to grow less rapidly then liabilities in reaction to changing demographic and economic conditions. Because of this, the asset/expenditure ratio fell from about six in 1985 to about two by the end of 2000. More importantly, during the 1993 to 1998 period, the asset growth rate was negative because some assets, in addition to all contributions and investment earnings, were being used to pay benefits.

The CPP amendments, which became effective on 1 January 1998, reversed this trend. Chart 17 shows that assets have started to grow again much more quickly than liabilities in the short- to medium-term and will thereafter always grow at a rate somewhat higher. This will result in the assets growing to a stable level of between five to six years of benefits from its current level of three over the next few decades. This clearly indicates that the 1998 amendments will rapidly put the CPP on a better financial footing over the foreseeable future as the growth in assets outpaces the growth in liabilities over the next 25 years. During that period the baby boom generation will have retired and, as a result of the baby bust, fewer young Canadians will replace them in the workforce.

Once the CPP has reached the higher funding level of about 25%, the long-term asset growth rate thereafter must be at least equal to the liability growth rate to ensure long-term financial sustainability. As shown in Chart 17, the asset and liability growth rates will stabilize at about 5% over the long term, making the Plan financially sustainable.

The notion of unfunded liability, especially if shown at only one particular point in time, is not a good indicator of the future financial health of the CPP. The evolution of the funding level and the projected growth rates of assets and liabilities are examples of better measures, as was demonstrated above.

III. Actuarial Balances

Is the Plan generating enough income to meet its obligations over the long run? This is the question that needs to be addressed to better quantify the Plan's viability in the long run. The answer to this question comes from analyzing the streams of future income and outgo of the Plan over various periods of time. These streams combined with initial assets can reveal whether the Plan has sufficient income to cover expenditures over these various time periods.

In this section, another measure of financial sustainability called the "actuarial balance" is discussed. For any given period, the actuarial balance is defined as the difference between (1) the sum of the beginning assets and the present value of contributions for the period and (2) the present value of the expenditures for the same period, each divided by the present value of the contributory earnings for all years in the period. The following general formula can be used for any valuation period.

Actuarial Balance = *Asset Rate* + *Income Rate – Expenditure Rate*

where:

Asset Rate (AR) = *CPP assets as at beginning of year expressed as a percentage of the present value of CPP contributory earnings over the valuation period.*

Income Rate (IR) = *Present value of CPP contributions over the period expressed as a percentage of the present value of CPP contributory earnings over the valuation period.*

Expenditure Rate (ER) = *Present value of CPP expenditures over the period expressed as a percentage of the present value of CPP contributory earnings over the valuation period.*

Note: The present value calculations take into account of the effect of interest on future income and expenditures. The interest rate assumed for discounting the stream of income and expenditures to the beginning of the period is the same as that used to calculate the interest earnings of the assets during the period.

A positive actuarial balance indicates that estimated income (assets and contributions) is more than sufficient to meet estimated CPP expenditures for the period as a whole; a negative actuarial balance indicates the opposite.

This calculation can be done for various subperiods of the projection period. In our analysis we look at 25, 50 and 75-year periods to get an overall picture of the actuarial status of the CPP over the long-term horizon. A 75-year period actuarial balance is a convenient financial measure that can be used to assess the CPP overall long-term projected financial status. Table 75 shows that the actuarial balance is always positive over periods ranging from 25 to 75 years, which is another indicator of the long-term financial sustainability of the CPP.

Table 75 Actuarial Balances Over Various Periods
(as % of present value of contributing earnings in period)

Period	Assets (AR)	Income (IR)	Expenditures (ER)	Actuarial Balance* (AR)+(IR)-(ER)
	(%)	(%)	(%)	(%)
2004-2028	1.31**	9.90	9.25	1.96
2004-2053	0.83**	9.90	9.92	0.81
2004-2078	0.69**	9.90	10.17	0.42
2029-2053	3.71	9.90	11.10	2.51
2054-2078	4.04	9.90	11.43	2.52

* Annual adjustment to the contribution rate that would result in exhaustion of the assets at the end of each period.
** Based on market value of assets of $68 billion at the end of 2003.

The 75-year actuarial balance of 0.42% shown in Table 75 (period 2004 to 2078) means that a contribution rate of 9.48% when combined with the CPP assets at the beginning of 2004 would be sufficient to meet all expenditures for the 75-year period with assets being exhausted by the end of the period.

IV. Reconciliation of Changes in Unfunded Liability

The major factors that account for the changes in the unfunded liability from the amount shown in the Eighteenth Actuarial Report are identified in Table 76.

Table 76 Reconciliation of Unfunded Liability with Previous Report
($ billion)

18th Report unfunded liability as at 31 December 2000	**443.0**
Plan Amendments	
- Bill C-3 (19th Report)	**(3.5)**
- Part 4 of Bill C-30 (20th Report)	**(0.3)**
Change for update to 31 December 2003	65.2
Methodology and experience update	26.0
Changes in key assumptions	
Fertility	0.0
Migration	(0.5)
Mortality	1.8
Disability	(23.9)
Employment	1.2
Real-wage differential	26.5
Price increases	(21.1)
Real rate of return on investments	18.4
Asset mix	(6.0)
Others	(6.8)
Sub-Total: Assumption Changes	**(10.5)**
Market Value Basis Adjustment	**(3.6)**
21st Report unfunded liability as at 31 December 2003	**516.3**

V. Internal Rates of Return

The internal rate of return is, with respect to a group of CPP participants born in a given year (i.e. a cohort), the unique interest rate resulting in the equality of:

- the present value of past and future contributions paid or expected to be paid by and in respect of that cohort, and

- the present value of past and future benefits earned or expected to be earned by that cohort.

Accordingly, actual internal rates of return cannot be determined until the last member of the cohort has died. However, they can be estimated based on the historical and projected experience of the cohort. Internal rates of return have been calculated on the basis of the best-estimate assumptions and using the legislated contribution rate of 9.9% for 2004 and thereafter.

The results presented in Table 77 are net rates in the sense that the administrative expenses associated with the cohort are not included in the value of the benefits. They are shown on two bases, as both nominal and real internal rates of return. To determine the real internal rates of return, both contributions and benefits were first adjusted to remove the impact of price increases.

Table 77 Internal Rates of Return by Cohort
(annual percentages)

Birth Year	Nominal	Real
1930	15.6	9.6
1940	10.5	6.2
1950	7.2	4.0
1960	5.6	3.0
1970	5.0	2.4
1980	4.9	2.1
1990	4.8	2.1
2000	4.8	2.1

The higher internal rates of return of the earlier cohorts mean that they are expected to receive better value from the CPP than those who follow. The differences provide an indication of the degree of intergenerational transfer inherent in the Plan. However, the fact that all of the rates in the table are greater than zero shows that each cohort is expected to realize a positive return from its investment in the CPP.

Appendix E – Reconciliation with Previous Report

I. Introduction

The results presented in this report differ from those previously projected for a variety of reasons. Differences between the actual experience during 2001 through 2003 and that projected in the Eighteenth Actuarial Report are addressed in section II below. Since historical results provide the starting point for the projections shown in this report, these historical differences also have an effect on the projections. The impacts of the experience update and other factors that have significantly changed the projected results are addressed in section III.

II. Financial Status – 2001 to 2003

The major components of change in the CPP assets from 31 December 2000 to 31 December 2003 are summarized in Table 78.

Contributions during the period 2001 to 2003 were about $1.7 billion more than projected. Over that period, contributory earnings were greater due to higher-than-expected levels of employment.

Expenditures during the period were $90 million less than projected, slightly increasing the positive impact of the higher contributions. This represents a deviation from expected of less than 0.1% and is mainly due to a slight over-projection of other than retirement benefits that outweighs the under-projection of retirement benefits and administrative expenses. The details by type of expenditure appear in Table 79.

Investment earnings were 10% lower than anticipated due to the general poor performance of financial markets over the period. Overall, assets increased by $20.3 billion during this period, 12% higher than the projected increase of $19.6 billion. This resulted in overall assets being 1% higher than projected over the same period.

Table 78 Financial Status - 2001 to 2003
(cost accrual basis, $ million)

	Actual	Expected	Difference	Ratio
Assets at 31 December 2000	**43,690**	**43,715**	**(25)**	**1.00**
+ Contributions	74,878	73,186	1,692	1.02
- Expenditures	64,898	64,988	(90)	1.00
+ Investment Earnings	10,357	11,438	(1,081)	0.90
Change in Assets	20,337	19,636	677	1.12
Assets at 31 December 2003	**64,028**	**63,351**	**677**	**1.01**

Table 79 Summary of Expenditures - 2001 to 2003
($ million)

	Actual	Expected	Difference	Ratio
Retirement	44,492	44,401	91	1.00
Disability	8,124	8,147	(23)	1.00
Survivors	9,065	9,127	(62)	0.99
Children	1,357	1,447	(90)	0.94
Death	676	762	(86)	0.89
Administrative Expenses	1,184	1,103	81	1.06
Total Expenditures	**64,898**	**64,987**	**(90)**	**1.00**

III. Changes in Pay-as-You-Go Rates – 2004 to 2075

The pay-as-you-go rate, which is the ratio of expenditures to contributory earnings in a given year, is an important measure of the cost of the CPP. One way of understanding the differences between the best-estimate projections in this report and those presented in the Eighteenth Actuarial Report is by looking at the effects of various factors on the pay-as-you-go rates. The most significant effects are identified in the reconciliation presented in Table 80 and the discussion below.

The methodology described in Appendix B reflects a number of improvements from that used in previous reports. These refinements had the effect of increasing the projected pay-as-you-go rates in most years.

The primary variations in experience during 2001 to 2003 were discussed in section II above. Experience update had the effect of reducing the pay-as-you-go rates in the short-term mainly due to a better than anticipated economic environment (especially labour force participation). On the other hand, the long-term effect of the experience update was to increase the projected pay-as-you-go rates due to a worse than anticipated demographic experience over the period 2001 to 2003 (especially higher life expectancies and lower fertility).

Changes made in the key assumptions from the previous report are outlined on page 14. The effects of these changes may be summarized as follows.

- The decrease in the ultimate fertility rate significantly increases the long-term pay-as-you-go rates, because its effect in slowing the growth in total contributory earnings outweighs the ultimate decrease in expenditures.
- The increase in the assumed level of net migration significantly decreases the pay-as-you-go rates, because its effect in increasing the growth in total contributory earnings outweighs the ultimate increase in expenditures.

- The slightly more rapid mortality improvements assumed for this report increase the pay-as-you-go rates, because beneficiaries are expected to receive their monthly benefits over longer periods of time.

- The update to the disability incidence and termination rates assumption has slightly reduced the pay-as-you-go rates over the projection period.

- The higher labour force participation rates assumed at older ages decrease the pay-as-you-go rates, although the effect declines with time as the higher participation translates into higher benefit entitlements.

- The change in the real-wage assumption increases the pay-as-you-go rates in the short term due to somewhat lower expectations over that period as compared to the previous report. On the other hand, the pay-as-you-go rates decrease in the long term due to the higher ultimate real wage assumption.

- The lower inflation rate assumption has the effect of increasing the pay-as-you-go rates. This counterintuitive result is caused by the fact that under a lower inflation assumption the benefits are fully affected, while the contributory earnings (between YBE and YMPE) are partially affected since the YBE is frozen at $3,500 over the entire projection period. The latter affect outweighs the expected decrease in pay-as-you-go rates due to lower benefits paid.

Some other less significant assumptions, which are described in Appendix B, were also changed. For example, the proportions of people aged 18 to 24 attending school full-time, used in the projection of orphan benefits, and the experience adjustment factors applied in the projection of retirement, disability and survivor benefits were revised to reflect more recent experience. Overall, the changes in these other assumptions had the effect of decreasing the projected pay-as-you-go rates over the long term.

Factors that lead to changes in the pay-as-you-go rates generally have comparable effects on the steady-state contribution rate. Furthermore, while the actual and assumed rates of return on investments have no effect on pay-as-you-go rates, they may have a significant impact on the steady-state contribution rate. A reconciliation of the change in the unrounded steady-state contribution rate from 9.795% shown in the Eighteenth Report to the new level of 9.770% in this report is provided in Table 81.

The change to a market value basis for valuing assets has the impact of reducing the steady-state contribution rate by 0.021%. The change in the funding target years from 2013 and 2063 to 2016 and 2066 has an impact on the steady-state contribution rate, as the asset/expenditure ratio in 2016 is somewhat higher than in 2013; this results in a higher funding target, which requires an increase of 0.027% in the steady-state contribution rate.

Table 80 Reconciliation of Changes in Pay-As-You-Go Rates

(% of contributory earnings)

	2004	2025	2050	2075
18th Report	**8.36**	**10.54**	**11.24**	**11.45**
I. Plan Amendments				
19th Report (Bill C-3)	0.00	0.00	0.00	0.00
20th Report (Part 4, Bill C-30)	0.00	(0.01)	(0.01)	(0.01)
Subtotal:	**0.00**	**(0.01)**	**(0.01)**	**(0.01)**
II. Improvements in Methodology	**0.07**	**0.03**	**0.05**	**0.05**
III. Experience Update (2001-2003)				
Demographic	0.06	0.14	0.29	0.24
Economic	(0.15)	(0.24)	(0.08)	(0.03)
Benefits	(0.06)	0.00	(0.04)	(0.05)
Subtotal:	**(0.15)**	**(0.09)**	**0.16**	**0.16**
IV. Changes in Assumptions				
Fertility	0.00	0.03	0.18	0.10
Net migration	0.00	(0.02)	(0.17)	(0.25)
Mortality	0.00	0.03	0.03	(0.02)
Disability	0.01	(0.04)	(0.02)	(0.02)
Employment	(0.14)	(0.12)	(0.03)	(0.01)
Real-wage differential	0.09	(0.02)	(0.16)	(0.18)
Price increases	0.00	0.09	0.10	0.08
Other assumptions	0.02	0.00	(0.08)	(0.03)
Subtotal:	**(0.02)**	**(0.05)**	**(0.15)**	**(0.33)**
Total of I to IV	**(0.09)**	**(0.12)**	**0.05**	**(0.13)**
21st Report	**8.27**	**10.42**	**11.29**	**11.32**

Table 81 Reconciliation of Changes in Steady-State Contribution Rate
(% of contributory earnings)

18th Report Rate - After Rounding	**9.800**
18th Report Rate - Before Rounding	**9.795**
I. Plan Amendments	
19th Report (Bill C-3)	(0.033)
20th Report (Part 4, Bill C-30)	(0.012)
Subtotal:	**(0.045)**
II. Improvements in Methodology	
Benefits	0.028
Market value of assets	(0.021)
Subtotal:	**0.007**
III. Experience Update (2001-2003)	
Demographic	0.167
Economic	(0.183)
Benefits	(0.025)
Investments	0.021
Subtotal:	**(0.020)**
IV. Changes in Assumptions	
Fertility	0.065
Migration	(0.055)
Mortality	0.026
Disability	(0.025)
Employment	(0.078)
Real-wage differential	0.007
Price increases	0.066
Asset mix	(0.036)
Real rate of return	0.064
Other assumptions	(0.028)
Subtotal:	**0.006**
V. Others (Change in funding target from 2013-2063 to 2016-2066)	**0.027**
Total of I to V	**(0.025)**
21st Report Rate – Before Rounding	**9.770**
21st Report Rate – After Rounding	**9.800**

Appendix F – Financial Projections with 9.8% Steady-State Contribution Rate

The results presented in Table 82 are based on the best-estimate assumptions but using the rounded steady-state contribution rate of 9.8% as opposed to the currently scheduled contribution rate of 9.9% for years 2007 and thereafter.

Table 82 Financial Results - 9.8% Steady-State Contribution Rate

($ million)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*	Asset/ Expenditure Ratio
	(%)	(%)							
2004	8.27	9.9	288,970	28,608	23,895	4,713	4,530	76,857	3.08
2005	8.36	9.9	298,643	29,566	24,967	4,599	5,565	87,021	3.33
2006	8.43	9.9	309,772	30,667	26,124	4,543	6,294	97,858	3.57
2007	8.51	9.8	322,095	31,565	27,412	4,153	6,852	108,863	3.78
2008	8.59	9.8	335,376	32,867	28,810	4,057	7,426	120,345	3.97
2009	8.67	9.8	349,556	34,256	30,292	3,964	8,130	132,440	4.16
2010	8.73	9.8	364,926	35,763	31,868	3,895	8,897	145,231	4.33
2011	8.81	9.8	381,122	37,350	33,567	3,783	9,724	158,739	4.48
2012	8.88	9.8	399,171	39,119	35,437	3,682	10,687	173,107	4.62
2013	8.97	9.8	418,003	40,964	37,491	3,473	11,799	188,380	4.75
2014	9.04	9.8	438,749	42,997	39,674	3,323	13,019	204,722	4.87
2015	9.13	9.8	460,396	45,119	42,022	3,097	14,345	222,164	4.99
2016	9.22	9.8	483,344	47,368	44,542	2,826	15,548	240,537	5.09
2017	9.31	9.8	507,310	49,716	47,212	2,504	16,801	259,843	5.19
2018	9.42	9.8	531,212	52,059	50,046	2,013	18,119	279,975	5.28
2019	9.55	9.8	555,717	54,460	53,056	1,404	19,480	300,860	5.35
2020	9.68	9.8	581,181	56,956	56,253	703	20,885	322,447	5.41
2021	9.83	9.8	606,726	59,459	59,632	(173)	22,339	344,614	5.45
2022	9.98	9.8	633,199	62,054	63,175	(1,122)	23,742	367,234	5.49
2023	10.13	9.8	660,470	64,726	66,907	(2,181)	25,174	390,227	5.51
2024	10.27	9.8	689,301	67,552	70,820	(3,269)	26,614	413,572	5.52
2025	10.42	9.8	718,640	70,427	74,887	(4,460)	28,080	437,192	5.53
2026	10.55	9.8	749,328	73,434	79,078	(5,644)	29,553	461,102	5.53
2027	10.66	9.8	782,108	76,647	83,366	(6,719)	31,145	485,527	5.53
2028	10.75	9.8	816,109	79,979	87,772	(7,793)	32,774	510,508	5.53
2029	10.84	9.8	852,033	83,499	92,328	(8,829)	34,420	536,099	5.53
2030	10.91	9.8	888,999	87,122	97,015	(9,893)	36,126	562,332	5.52
2031	10.97	9.8	928,021	90,946	101,817	(10,871)	37,879	589,340	5.52
2032	11.00	9.8	969,672	95,028	106,708	(11,680)	39,690	617,350	5.53
2033	11.03	9.8	1,012,946	99,269	111,710	(12,441)	41,570	646,479	5.53
2038	11.07	9.8	1,261,472	123,624	139,586	(15,962)	52,251	812,444	5.57
2043	11.09	9.8	1,565,990	153,467	173,721	(20,254)	65,670	1,021,024	5.62
2048	11.23	9.8	1,931,223	189,260	216,809	(27,549)	82,094	1,275,465	5.63
2053	11.38	9.8	2,374,787	232,729	270,228	(37,499)	101,537	1,576,156	5.58
2058	11.50	9.8	2,920,144	286,174	335,840	(49,666)	124,239	1,927,009	5.50
2063	11.50	9.8	3,603,456	353,139	414,391	(61,252)	151,057	2,342,626	5.43
2068	11.40	9.8	4,459,735	437,054	508,373	(71,319)	184,181	2,857,694	5.40
2073	11.32	9.8	5,514,213	540,393	624,359	(83,966)	225,987	3,507,790	5.39
2078	11.34	9.8	6,795,646	665,973	770,640	(104,667)	277,796	4,311,381	5.36

* All assets components are valued at market.

Appendix G – Acknowledgements

Social Development Canada provided statistics on the Canada Pension Plan beneficiaries, contributors and assets.

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The following people assisted in the preparation of this report:

Yu Cheng
Patrick Dontigny
Alain Guimond, A.S.A.
Sari Harrel, A.S.A.
Lyse Lacourse
Danita Pattemore, A.S.A.
Louis-Marie Pommainville, F.S.A., F.C.I.A.
Annie St-Jacques